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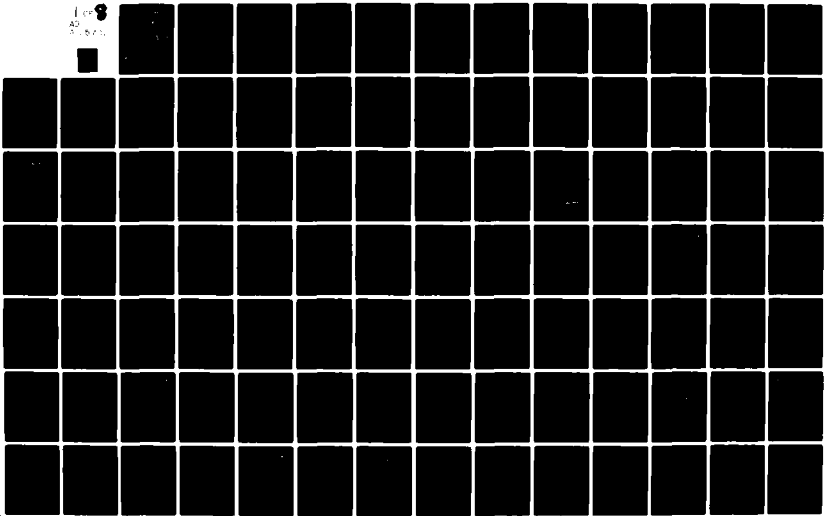

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U.S. Department of Transportation
Federal Aviation Administration

Office of Aviation Safety
Washington, D.C. 20591

Summary Of Federal Aviation Administration Responses To National Transportation Safety Board Safety Recommendations

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LEVEL II

Report No. FAA-ASF-81-4

Quarterly Report

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16. Abstract

This report contains NTSB recommendations and all FAA responses to Board recommendations that were delivered to the Board during the applicable quarter. In addition, the report includes NTSB requests and FAA responses concerning reconsiderations, status reports, and followup actions.

The Table of Contents for this report reflects only those NTSB recommendations which are still open pending FAA action (i.e., those that have not been designated as "Closed" by the NTSB as a result of acceptable action). Accordingly, the Table of Contents may reflect a number of multiple recommendations (example: A-79-21 through 24), but background material is included only for those recommendations which remain in an "Open" status. Background information for those recommendations which have been closed is available in FAA Headquarters files.

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FOREWORD

The National Transportation Safety Board as established by Public Law 93-633, Title III, "Independent Safety Board Act of 1974," has among its duties the requirement to ". . . issue periodic reports to the Congress, federal, state, and local agencies concerned with transportation safety, and other interested persons recommending and advocating meaningful responses to reduce the likelihood of recurrence of transportation accidents and proposing corrective steps."

The Act specifies that whenever the Board submits a recommendation regarding transportation safety to the FAA, or other agencies of the Department of Transportation, that the agency shall respond to each such recommendation formally and in writing not later than 90 days after receipt thereof. The Act also requires that the response to the Board shall indicate the agency's intention to initiate adoption of the recommendation in full or in part, or to refuse to adopt such recommendation, in which case the response shall set forth in detail the reasons for the refusal.

A notice of each recommendation and the receipt of a response from the agency is published in the Federal Register. There is no requirement to publish either the recommendation or the response in its entirety.

The Federal Aviation Administration places a high priority on the evaluation of the Board's investigation and its recommendations. In recognition of the importance of these recommendations and the responses, the FAA, beginning with the first quarter of calendar year 1980, publishes quarterly reports of NTSB recommendations and all FAA responses to Board recommendations that were delivered to the Board during the applicable quarter. In addition, the report includes NTSB requests and FAA responses concerning reconsiderations, status reports, and followup actions.

The NTSB system of priority classification for action provides for documented NTSB followup action for each safety recommendation in accordance with one of the following classifications:

1. Class I - Urgent Action: Urgent commencement and completion of action is mandatory to avoid imminent loss of life or injury and/or extensive property loss.

2. Class II - Priority Action: Priority commencement of action is necessary to avoid probable loss of life or injury and/or property loss.

3. Class III - Longer-Term Action: Routine action is necessary so that possible future injury and loss of life and property may be avoided.

The purpose of this publication is to provide a systematic quarterly update and summation of NTSB Safety Recommendations and FAA actions and reponses. -This document is intended to keep the public abreast of NTSB and FAA efforts in the area of aviation safety for the applicable quarter covered by the report.

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Initial FAA Responses:

SUMMARY

Statistics for CY 1980 included:

115 new recommendations issued to the FAA

74 recommendations officially "Closed" during this period

The following exchanges of NTSB/FAA correspondence concerning NTSB Safety Recommendations occurred during the second quarter, April 1 - June 30, 1981:

- FAA initial responses to NTSB recommendations: 19 letters involving 46 recommendations.
- FAA letters to NTSB discussing reconsideration of earlier responses, current status, or followup actions: 17 letters involving 35 recommendations.
- FAA "final report" letters to NTSB: 28 letters involving 63 recommendations.

Officially "Closed" by the NTSB during this quarter: 41 recommendations.

There were 2 FAA responses to 3 Class I--Urgent Action recommendations during this quarter.

Accident Date	Recommendation Number	Issue Date	Response Date	FAA Action
8/19/80	A-81-12	2/10/81	5/11/81	Research program underway.
1/20/81	A-81-39 & 40	3/30/81	6/26/81	FAA/NOS study underway.

The FAA response to Class I - Urgent Action recommendations is reflected in the following summaries:

A-80-112.

On February 12, 1979, an Allegheny Airlines Nord 262 crashed on takeoff from Clarksburg, West Virginia. The accident resulted in two fatalities and seven serious injuries. At the time of takeoff, there were light snow showers at the airport with an estimated accumulation rate of approximately 1 inch per hour. Deicing of the aircraft, with a 78 percent solution of an ethylene glycol-based deicing fluid and water, was completed 25 to 40 minutes prior to takeoff. Witnesses reportedly saw snow on the exposed horizontal surfaces of the aircraft when it taxied out. The probable cause of the accident was determined to be, in part, the loss of lateral control and lift due to snow on the wings and empennage when the aircraft climbed out of ground effect. The presence of frozen snow on the upper horizontal airfoil surfaces was confirmed by photographs after the accident.

On February 18, 1980, a Redcoat Air Cargo, Ltd., Bristol Brittania 253, crashed shortly after takeoff from Logan International Airport, Boston. The accident resulted in seven deaths and one serious injury. Light snow had fallen throughout the period of flight preparation, taxi, and takeoff at a rate of between 0.5 and 0.8 inch per hour. The aircraft had been deiced with a 30 percent solution of an ethylene glycol-based deicing fluid 45 to 60 minutes prior to takeoff. Evidence indicates that wet snow, which accumulated on the wings and horizontal stabilizer prior to takeoff, was a major factor in this accident.

According to the NTSB, an ethylene glycol-water mix is useful as a deicing agent, but only the undiluted fluid is recommended by the manufacturer as an anti-icing agent. The Board claimed that in the above accidents, the very fact that the exposed airfoil surfaces were wetted may have actually enhanced the accumulation of wet snow and created a condition in which the wet snow was not blown off by air moving over the surfaces.

Accordingly in Safety Recommendation A-80-112, the NTSB recommended that the Federal Aviation Administration (FAA) "Advise operators of the potential hazard of an accumulation of wet snow on airfoil surfaces after deicing with a diluted ethylene glycol solution.

The FAA concurred in this recommendation and issued Air Carrier Operations Bulletin Number 7-81-1, dated April 10, 1981, to emphasize the danger of snow accumulation on aircraft following deicing. Operators were requested to review their deicing and anti-icing procedures in view of these accidents. By letter dated March 30, 1981, the NTSB expressed pleasure with FAA's action and classified Safety Recommendation A-80-112 in an "Open—Acceptable Action" status pending receipt of the operations bulletin. A copy of the document was subsequently forwarded to the Board, thereby completing action. The FAA is currently awaiting a reclassification to "Closed" status from the NTSB on Safety Recommendation A-80-112.

A-80-115.

On June 12, 1980, an Air Wisconsin Swearingen SW-4 crashed during an encounter with a level 5 or greater thunderstorm in eastern Nebraska. Thirteen persons were killed and two persons were seriously injured.

During its flight, the aircraft had been under the control of the Minneapolis Air Route Traffic Control Center's (ARTCC) Omaha low altitude section, as well as other sectors within the same ARTCC. However, the Safety Board's investigation revealed that none of the sector controllers transmitted information to the flightcrew regarding the location and intensity of the thunderstorm system in the path of the flight, although other ARTCC air traffic control (ATC) and meteorological personnel had some information regarding the potential intensity characteristics of the storm system. Testimony given at a public hearing held in Omaha, Nebraska, during September 1980 indicated that the full extent of the area of precipitation and accurate intensity characteristics of convective meteorological phenomena are not portrayed on a controller's plan view display (PVD) because the weather fixed map unit (WFMU) is designed to be selective in its display of precipitation and is limited in its capability to display weather echo intensity levels. A controller's only alternative to obtain a more complete view of the precipitation in the area is to switch to the older broadband presentation; however, this equipment also does not have the capability of showing the various weather echo intensity levels. Further, the broadband presentation may not show aircraft which have already penetrated precipitation areas, essentially rendering this radar useless for purposes of vectoring aircraft out of areas of precipitation.

On February 24, 1980, a Beechcraft Bonanza BE-35 aircraft crashed near Valdosta, Georgia, during an encounter with severe thunderstorms. All the occupants aboard were killed when the aircraft broke up in flight. On August 26, 1978, two persons were killed when a Piper PA-28 aircraft experienced an inflight breakup during an encounter with a severe thunderstorm near Bolton, North Carolina. In both accidents, ARTCC controllers attempted to provide weather information and avoidance vectors around areas of precipitation observed on the PVD's by switching to broadband presentations to obtain a more complete characterization of the weather than that displayed on the narrowband WFMU.

In the investigations of the three accidents cited above, the NTSB stated that ATC personnel alluded several times to the fact that, in some instances, inconsistencies between the weather displayed on the PVD and the actual weather encountered by the aircraft limited their ability to confidently assist aircraft. As part of the investigation of the June 12, 1980, crash, the Safety Board examined the National Weather Service (NWS) weather radar color remote displays located at the Cleveland ARTCC. The FAA intends to test the possible use of similar displays as an adjunct to the present narrowband WFMU system, and the Board believes such use would significantly contribute to aviation safety.

According to the NTSB accounts, on the evening of September 22, 1980, an unusually large area of extreme convective weather extended from Ontario, Canada, south to Jonesboro, Arkansas. Several supervisors and controllers

at the Cleveland ARTCC reported that, while experiencing difficulty in correlating the NWS radar maps with the ATC PVD maps, they were able to achieve sufficient correlation to issue advisories to aircraft regarding the extreme weather displayed on the NWS weather radar color remote displays in the center. In one notable instance, the PVD display of weather over the Detroit airport did not show the presence of the ongoing thunderstorm activity which was displayed clearly on the NWS weather radar color remote display. The controllers were able to use the NWS weather radar information to divert aircraft away from the Detroit airport. Throughout the evening of September 22, numerous air carrier flights were assisted in avoiding the weather which was characterized as severe and extreme on the NWS weather radar color remote displays. The comments by the ATC personnel involved were almost unanimously positive regarding this potential use of the NWS weather radar color display, even in the face of the problems of map correlation and weather intelligence updating. The FAA is seeking to resolve these problems before the test program is begun, since the contemplated tests cannot commence until some remaining mapping graphics problems have been solved. The FAA informed the Board that, in the immediate future, the Cleveland ARTCC's Center Weather Service Unit (CWSU) is scheduled to acquire 25-inch NWS weather radar color remote displays which will enable the CWSU meteorologists to obtain real-time weather information directly from NWS weather radars. The Board believes that installation of these radars in all ARTCCs having CWSUs should be expedited to provide real-time depiction of the location and intensity of all convective meteorological phenomena affecting a center's airspace. Therefore, the NTSB recommended that the FAA "Expedite the delivery of NWS weather radar color remote displays to all Air Route Traffic Control Centers' Center Weather Service Units."

The FAA concurred in this recommendation and informed the Board that every effort is being made to expedite delivery of the color display. All contract negotiations have been completed, and the delivery schedule has been finalized. The first delivery was scheduled for June 1981 and the last for May of 1982. A copy of the NTSB recommendation was provided to all participants of the weather radar remote program in order to emphasize the urgency of this effort.

By letter dated April 10, 1981, the NTSB expressed pleasure with the FAA actions in progress toward fulfilling the intent of Safety Recommendation A-80-115. This recommendation has been classified in an "Open-Acceptable Action" status.

A-80-120.

On Monday, November 17, 1980, a Piper PA-38 crashed and two persons were killed near Santa Rosa, California, when the plane's engine failed shortly after takeoff. The engine, a Lycoming O-235-L2A, was manufactured in 1979 and had accumulated about 70 hours at the time of the accident.

Disassembly of the engine disclosed that two intake valve pushrods had failed, and as a result their length had been shortened. One of the pushrods was too short to operate the rocker arm; the other pushrod was still operating its rocker arm, but the amount of valve opening and the valve timing had been reduced considerably.

The pushrods consisted of a hollow aluminum tube with a steel ball-end insert which was pressed into the end of the tube. When the rods failed, the aluminum tube bulged immediately below the flange of the steel insert. One aluminum tube had split longitudinally and had peeled back, and as a result, the steel insert had been forced into the tube more than one-fourth inch. The operator of the PA-38 discovered two other engines with similar pushrod damage. Both were Lycoming O-235-L2C. In one case, the tube bulging was visible on two rods but was not considered severe; the engine had 350 service hours since new. In the other case, all eight tubes were severely compressed or bulged and were beginning to split. This engine had 1,050 service hours since new.

According to the NTSB, the engine manufacturer indicated that it was aware of pushrod problems in service, but had not been aware of any failures that progressed to the point of engine failure. According to the manufacturer, the rate of occurrence of the failures was decreasing, and there were no plans for taking further corrective action.

The Safety Board, however, considered immediate action necessary to preclude further engine failures of this type. Therefore, the NTSB recommended that the FAA issue an Emergency Airworthiness Directive requiring, before further flight, (1) the immediate inspection of pushrods, of all Lycoming O-235-L2C engines, and (2) replacement of damaged or bulging aluminum pushrods.

The FAA concurred in this recommendation, and Emergency Airworthiness Directives AD-80-25-02 and AD-80-25-02R1, requiring repetitive inspections, at 25-hour intervals, of valve clearances (intake and exhaust), were issued. These inspections are intended to discover any incipient damage to the pushrods before the damage progresses to the point of engine failure. Also, Lycoming Service Instructions Nos. 1068A and 1388A continue in effect. These publications specify the engine manufacturer's valve clearance inspections.

By letter dated April 15, 1981, the NTSB expressed pleasure with FAA's issuance of the emergency ADs and classified Safety Recommendation A-80-120 in a "Closed--Acceptable Action" status.

A-81-1,2,3, and 5.

A Lockheed L-1011-200 aircraft operated by a foreign carrier experienced an in-flight failure of a main landing gear inboard wheel flange. The failure caused major damage to flight control, electrical, and hydraulic systems, caused major damage to the aircraft structure, and resulted in explosive decompression of the cabin. There were two fatalities. Members of the FAA technical staff worked closely with the National Transportation Safety Board's staff to determine the nature of the problem and the corrective actions required to prevent similar occurrences.

The investigation revealed that the failed wheel was a B.F. Goodrich Part No. (P/N) 3-1365, Serial No. (S/N) 185. Information from Goodrich and Lockheed disclosed that Goodrich wheels P/N 3-1311-3 and P/N 3-1365 were both qualified to technical standard order (TSO) requirements for use on L-1011 aircraft having a maximum gross takeoff weight of up to 460,000 pounds. Domestic air carrier users of the L-1011 reported a significant number of fatigue-related failures of the P/N 3-1311 wheels, but the P/N 3-1365 wheels have had a satisfactory service history. Goodrich warranty provisions, the relative service histories, and Goodrich Service Bulletin No. 369 all fostered the belief that the P/N 3-1365 wheels were stronger than the P/N 3-1311 wheels. Consequently, most operators use only the P/N 3-1365 wheels on those L-1011 aircraft operating at high gross weights.

Goodrich Service Bulletin No. 369 states that the thickness of P/N 3-1365 wheel outer flanges up to S/N 1404 are 0.490 to 0.550 inch. However, the investigation revealed that Goodrich manufactured an early quantity of wheels given P/N 3-1365 which were dimensionally and materially identical to the P/N 3-1311 wheels. Subsequent engineering drawing changes strengthened the P/N 3-1365 wheel by including thicker outer flanges, anodizing, and shot peening. Goodrich initially stated that the first flange dimensional change to the P/N 3-1365 wheel was effective on S/N 165. However, a postaccident laboratory examination disclosed that the outer flange of the failed wheel, S/N 185, measured less than 0.470 inch which is below the minimum tolerance of 0.490 for the strengthened P/N 3-1365 wheel. The Service Bulletin does not mention that an early quantity of P/N 3-1365 wheels were manufactured before the engineering changes were incorporated.

Goodrich Service Bulletin No. 369 also states that the thickness of the P/N 3-1311 wheel outer flanges are 0.450 to 0.510 inch. According to engineering drawings submitted to the Safety Board by Goodrich, the specified dimensions for the P/N 3-1311 outer flanges are 0.410 to 0.470 inch. The NTSB believes that these errors are indicative of lax quality control procedures. The Board stated that the erroneous Service Bulletin information is misleading to the user and could contribute to confusion regarding the strength and durability of those wheels which are selected for use on L-1011 aircraft having higher gross weight configurations. According to the NTSB, additional uncertainty as to the actual dimensional characteristics of the P/N 3-1365 wheels is created by the fact that Goodrich has previously indicated that P/N 3-1365 wheel assemblies up to about S/N 165 are the "same" as P/N 3-1311 assemblies. Disclosure of the less than 0.470 inch flange thickness on the failed S/N 185 wheel assembly thus creates a question as to exactly how many wheels with these dimensions are identified as P/N 3-1365 assemblies.

Discussions among the FAA staff, the Safety Board staff, and the domestic air carriers disclosed that all of the operators employ some inspection programs involving periodic eddy current or dye penetrant techniques. Before the accident, it was generally believed that these programs were effective in detecting fatigue damage before catastrophic failure. However, the Safety Board expressed concern that the inspection requirements are not standardized and have not been uniformly effective in reliably detecting cracks prior to in-service failures. The foreign operator involved in this accident also used an eddy current inspection program and the failed wheel was inspected only 28 cycles before the accident. The Safety Board expressed belief that an effective inspection program is a vital element in the prevention of wheel failures and that the procedures proven by industry experience to be effective should be identified and required to be implemented by all carriers.

The Safety Board also noted from Service Difficulty Reports that wheel failures were occurring with nearly all types of commercial aircraft. Therefore, the Safety Board contends that action to establish more reliable wheel inspection procedures should not be limited to the L-1011 wheels. Accordingly, the NTSB directed the following Urgent Action recommendations to the FAA:

A-81-1.
"Issue an immediate Airworthiness Directive to require that operators of L-1011 aircraft at the next tire change or within 20 cycles, whichever is sooner, measure the flange thickness on all P/N 3-1365 wheels with serial number up to 1404 which have been used on aircraft with a gross takeoff weight of 430,000 pounds or more, and include in the Airworthiness Directive a requirement to remove all wheels with outer flange thicknesses of less than 0.490 inch and installed on aircraft operating at gross takeoff weights of 430,000 pounds or more. Further requirements should include at each wheel disassembly of all P/N 3-1365 and P/N 3-1311 wheels, an inspection in accordance with procedures which have been evaluated by the FAA and demonstrated by industry experience to be effective in detecting in-service cracking prior to failure."

A-81-2.
"Initiate an immediate survey of B.F. Goodrich manufacturing facilities by a Quality Assurance Systems Analysis Review Team or equivalent to assure the manufacturer's compliance with current regulatory requirements governing production certification and specifically the issuance and approval of service bulletins, investigation and reporting of service difficulties, maintenance of appropriate production and inspection records, and coordination of service difficulties with primary airframe manufacturers."

A-81-3.
"Require tire, wheel, and airframe manufacturers to publish and disseminate to all operators all engineering data necessary to determine the effect on fatigue life of aircraft wheels by increasing or decreasing tire inflation pressures."

A-81-5.
"Expeditiously disseminate any required wheel inspection and service programs to all foreign civil aviation authorities with regulatory responsibilities over operators of U.S.-manufactured aircraft and equipment."

In responding, the FAA separated Recommendation A-81-1 into two parts: First, to require early identification and removal of wheels with outer flange thicknesses of less than 0.490 inch, i.e., "thinner flange wheels," from airplanes having a takeoff gross weight of more than 430,000 pounds, but not greater than 466,000 pounds, i.e., "heavier airplanes;" and, secondly, to require appropriate inspections of wheels at each wheel disassembly, i.e., at each tire change. Each of these parts was addressed separately.

The FAA stated that the B.F. Goodrich P/N 3-1311 and P/N 3-1365 wheels, including the thinner flange P/N 3-1365 wheels, are approved for installation on the heavier airplanes. The agency reevaluated this approval and found no significant difference in safety between these parts. The dimensional differences are slight, and, considering the typical fatigue failure mode, the increased thickness is not, of itself, significant enough to contribute to the safety of the wheel.

There were strong indications that corrosion pits initiated the crack that caused the subject wheel failure. Corrosion has been present in many of the cracked or failed wheels from L-1011 airplanes that have been returned to B.F. Goodrich or Lockheed for analysis. Once a surface anomaly such as a corrosion pit develops, and these can develop at any time during the wheel service life, a fatigue crack can be expected to initiate and grow from that anomaly. The minor differences in flange thickness is an insignificant factor when this phenomenon occurs.

FAA specialists worked with specialists from Lockheed and B.F. Goodrich in an effort to investigate the crack propagation characteristics of a thinner flange wheel on a heavier airplane once a detectable fatigue crack is present. The purpose of the investigation was to determine the appropriateness of present inservice inspection intervals. Enlarged photographs of the fracture surface of the subject failed wheel were compared with the fracture surfaces of four other wheels that had been returned to Lockheed for analysis prior to the subject failure. In all cases, "marker bands" are apparent that can be correlated with the number of landings. Fractographic analysis showed that, for typical wheel failures originating from a surface anomaly such as a corrosion pit, which would be the most severe case of stress concentration, inspection using appropriate procedures at every tire change will allow several inspection opportunities to detect a crack prior to wheel flange failure on the thinner flange wheels, even on the heavier airplanes.

Accordingly, the FAA concluded that appropriate flange inspection procedures, including method and period, are the key factors in preventing future wheel flange fatigue failures on L-1011 airplanes. Given the proper inspection, the differences in flange thickness are insignificant to safety. Moreover,

if a proper inspection program is not implemented, the differences in flange thickness would not significantly forestall failure. Since the FAA does not find the differences in flange thickness significant to safety, the agency was unable to justify the initiation of the action recommended, i.e., flange wheels measurement or removal of wheels with thinner flanges.

The last sentence of the recommendation seemed to infer that there was no effective inspection procedure in use by the operators to detect inservice wheel cracking prior to failure. At the joint FAA/NTSB meeting with the Air Transport Association (ATA) member operators of L-1011 airplanes at Atlanta, Georgia, on December 31, 1980, several eddy current inspection techniques were described that are presently being used by L-1011 operators. Data was presented which showed that L-1011 wheel cracks are being detected on a regular basis prior to inservice failure. One of the operators rejected 73 wheels in a 29-month period using these eddy current inspections. All of the inspection procedures used by the operators are reviewed by the FAA and approved as part of the operators' maintenance procedures. Thus, the basic intent of the last sentence of the recommendation was already being accomplished.

Since the joint FAA/NTSB/ATA meeting, the FAA monitored an analysis by Lockheed and B.F. Goodrich to improve even further the safety record of L-1011 wheels by defining an optimum inspection procedure for all wheels used on all L-1011 series airplanes. Many L-1011 operators had been involved in this intense effort at Lockheed. The FAA is confident that an optimum eddy current wheel flange radius inspection procedure for these B.F. Goodrich wheels has been developed. Consistent with this determination and in concurrence with the second part of this recommendation, the FAA decided to issue an Airworthiness Directive (AD) to require application of these procedures at an appropriate inspection interval. This AD was issued as a final rule on March 13, 1981, and the NTSB was so informed, and a copy transmitted, by FAA's letter dated May 26, 1981. The FAA has received no further correspondence from the Board relative to this recommendation.

In response to Safety Recommendation A-81-2, the FAA stated that upon return of the failed wheel to the NTSB metallurgical laboratory in Washington, D.C., it was noted that the outboard wheel half P/N 10-1323 had been stamped over a previously stamped P/N 10-1213.

As soon as the part number overstamping, i.e., part renumbering on the subject wheel, was observed, the FAA requested the Great Lakes Region manufacturing specialist to initiate an investigation at B.F. Goodrich. FAA's manufacturing specialist visited the B.F. Goodrich plant on December 30, 1980, and, as reported at the joint FAA/NTSB/ATA meeting at Atlanta, Georgia, on December 31, 1980, found that the part renumbering was covered by appropriate engineering orders which FAA's review has shown to be appropriate. The error with respect to identification of the P/N 3-1311-3 cross-section shown on B.F. Goodrich Service Bulletin No. 369, which confused both the FAA and NTSB investigators at the outset, had no relationship to the

B.F. Goodrich quality control system. In the service bulletin figure, B.F. Goodrich erroneously labeled the outboard flange of the P/N 3-1311-3 wheel with the inboard flange dimensions. The FAA did not find that the errors in the service bulletin were indicative of lax quality control procedures at B.F. Goodrich. Also, since it was concluded that there was no safety significance to the small differences in flange thickness through the change in P/N's 3-1311-3 to 3-1365, the agency did not find that the confusion in part numbers could have contributed to the subject wheel failure.

Notwithstanding these findings and consistent with the NTSB recommendation, the FAA completed a special Quality Assurance System Analysis Review (QASAR) audit of the B.F. Goodrich wheel manufacturing facility at Troy, Ohio, on January 12 through 14. Emphasis was placed on reviewing the production and quality control procedures applied to the manufacture of wheels for L-1011 airplanes. The QASAR team leader advised that there were no safety significant deficiencies found that could have contributed to the subject wheel failure, or that would affect the safety of wheels being manufactured at the facility.

The Board was informed that action is considered complete on Safety Recommendation A-81-2, but no classification has been received from the NTSB.

In responding to Safety Recommendation A-81-3, the FAA noted that the predicate of this recommendation appeared to be that a discrete fatigue life could be placed on an aircraft wheel and used to prevent wheel failures. Since experience with prior cracks in L-1011 wheels indicates that surface anomalies (corrosion pits, etc.), are the principal initiators of wheel flange fatigue cracks, which may occur at any wheel service life and are independent of variations in operational stress level due to differences in tire pressure, the FAA did not find this predicate valid.

The FAA hired an internationally respected specialist in fracture mechanics and metallurgy. This specialist had been working with Lockheed and B.F. Goodrich in their analyses of the subject wheel failure and their review of earlier, less catastrophic failures. He was asked to continue his study of the wheel fatigue phenomenon on all U.S.-manufactured transport category airplane types in service so that we might better understand and thus minimize future wheel failures from whatever cause. As stated in response to Recommendation A-81-1, the FAA believes the key to precluding "on-airplane" wheel flange failures lies in the integrity of the operators' wheel inspection program. As more is learned about the wheel flange fatigue phenomenon, improved wheel inspection procedures and periods will be defined for each wheel model.

The Board was informed that the FAA is concerned that the premature dissemination of the tire pressure effects information relative to the NTSB recommendation could cause operators to reduce tire pressure to reduce wheel fatigue. The agency is concerned that since corrosion pits or other surface anomalies appear to be the predominant fatigue initiators, this action could lead to a false sense of security without improving wheel safety. Accordingly, the FAA informed the Board that we do not plan to implement Safety Recommendation A-81-3.

In responding to Safety Recommendation A-81-5, the Board was informed that on January 9, 1981, the Director of Airworthiness sent an "Urgent Maintenance Alert" telegraphically to the airworthiness authorities of all countries having L-1011 airplanes on their registry. The alert was also directed to the ATA and International Air Transport Association for dissemination to their member carriers. The alert emphasized the importance of an eddy current inspection of the critical wheel flange area at each tire change. The information in that alert was upgraded by the AD referenced in our response to Recommendation A-81-1.

The Board was further informed that any new information gained as a result of FAA's wheel study, referenced in response to Recommendation A-81-3, would be made available to foreign authorities and all operators on a priority basis. This action fully satisfied the intent of Safety Recommendation A-81-5. The FAA is also awaiting a further response from the NTSB relative to this recommendation.

In the FAA response to these four Safety Recommendations, a segment was devoted to technical corrections and clarification. The agency was compelled to include these comments because the preamble to Safety Recommendations A-81-1 through A-81-5 contained a number of factual errors that required correction for the record. The general content of these comments is reflected below.

In Recommendation A-81-1, the B.F. Goodrich P/N 3-1311-3 and 3-1365 wheels are approved for use on L-1011 airplanes having a maximum certificated gross takeoff weight of up to 466,000 pounds, not 460,000 as stated. The NTSB further stated: "Subsequent engineering drawing changes strengthened the P/N 3-1365 wheel by including thicker outer flanges, anodizing, and shot peening." Anodizing does not strengthen the wheel, but is used to improve the corrosion resistance of the wheel. A review of drawing 10-1323, which makes up the outer half of wheel assembly P/N 3-1365, shows that the inside radius of the wheel bead, where the crack occurred, is not shot peened but is stress rolled. Other portions of the wheel are shot peened. The stress rolling of the wheel bead was not added as a revision to the drawing but was on the initial issue of the drawing.

In our response, the FAA also attempted to clarify certain issues contained in the remaining text. The Board stated in its letter that domestic air carriers have reported a significant number of fatigue-related failures of B.F. Goodrich P/N 3-1311-3 wheels, while P/N 3-1365 wheels have a satisfactory service record. It was pointed out that both of these wheels were certificated to the same load rating for use on L-1011 airplanes up to a gross weight of 466,000 pounds, and both part number wheels have a satisfactory safety-related service record. The service record does not show a significantly higher failure rate of P/N 3-1311-3 or thin-flanged P/N 3-1365 wheels operated on airplanes with gross weights of 466,000 pounds. The FAA has not found that the P/N 3-1311-3 or P/N 3-1365 wheels with the thinner flanges have a more significant number of fatigue-related failures, and, in absence of engineering data to the contrary, finds that the

P/N 3-1311-3 and P/N 3-1365 wheels are safe on all gross weight airplanes up to 466,000 pounds. The changes in P/N 3-1365 wheel flange thickness were instituted to increase service life and are not related to safety deficiencies. Some operators may elect to use only the P/N 3-1365 thicker flange wheels on high gross weight L-1011 airplanes to increase the service life of the wheels.

The Board was also advised of an apparent inference in the text of the discussion concerning these recommendations that inservice wheel rejections as a result of cracks are indicative of poor wheel design. These wheels were designed to meet the requirements of TSO-C26b, and the warranty service life desired by operators. The desired wheel life strongly dictates the design of the wheel. Wheels are not life limited but are used in service until cracks are detected, and the wheel is then scrapped. Airline maintenance procedures and inspection intervals are designed and FAA-approved to detect cracks prior to catastrophic failure of the wheel. The criterion of concern with respect to wheels is not the total number of wheel rejections, but whether the occurrence of a catastrophic crack between inspection intervals can be prevented.

The FAA considers action completed on Safety Recommendations A-81-1, 2, 3, and 5.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

April 3, 1981

OFFICE OF
THE ADMINISTRATOR

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-125 through 80-131 issued by the Board on December 31, 1980. These recommendations resulted from the Board's assessment of the adequacy of occupant protection in general aviation aircraft during a crash. This also responds to NTSB Safety Recommendations CY-70-42, Part 4, and A-77-70, which were reiterated as a part of this recommendation package.

CY-70-42, Part 4. [Initiate] regulatory action . . . to raise the "minor crash landing" inertia forces of [14 CFR] 23.561 to a level comparable to those produced by a moderate-to-severe crash landing. Until a reasonable crash design condition is decided upon, including a specified crash acceleration pulse, it is suggested that the longitudinal inertia force be raised to 20 to 25 and the forces about other axes be similarly increased. (Recommendation Status: Previously closed when the FAA issued an NPRM whose requirements, if made final, would have accomplished the recommended action.)

FAA Comment. The Federal Aviation Administration (FAA) does not concur in pursuing action that would arbitrarily raise the longitudinal inertia forces from 20 to 25 g's, until a reasonable dynamic design condition is decided upon. In testimony before the House Subcommittee on Oversight and Review on June 3, 1980, Chairman King stressed the importance of energy absorbing seat designs for transport category airplanes. Energy absorbing seats are even more desirable in general aviation airplanes because of the reduced amount of energy absorbing fuselage material beneath the occupant. Raising the static inertia forces for design of seats will make the seats stronger and also stiffer. Thus, more of the crash load will be transmitted to the occupant, and presently survivable crashes may become unsurvivable. The approach the FAA is taking, which we believe to be the correct one, is to define the dynamic crash input and then "tune" the seat deflection and energy absorption characteristics for maximum occupant survival. We will keep the Board informed of significant progress in this research effort.

A-77-70. Amend 14 CFR 23.785 to require installation of approved shoulder harnesses at all seat locations as outlined in NPRM 73-1. (Recommendation Status: Open, Unacceptable Action)

FAA Comment. Regulatory analysis regarding reassessment of Amendments 23-19 and 91-139 was completed in October 1980. After conducting in-house meetings during October 1980, it was concluded that cost benefit analysis would not be required prior to proceeding with the draft notice. However, it was determined that the analysis must be revised so as to reflect various options for small airplanes with seating capacities of less than nine. We are currently in the process of completing this revision. We now plan to have a draft Notice of Proposed Rulemaking (NPRM) ready for coordination in April 1981, with issuance of the NPRM scheduled during June of 1981.

Moreover, the FAA is studying the feasibility of requiring installation of approved shoulder harnesses at all seat locations under an existing regulatory project. In this feasibility study many schemes for accomplishing shoulder harness retrofit are being considered in addition to changes to FAR 23.785, which would affect only new type designs. The economic impact of the various schemes is being carefully assessed. The FAA is also working on a proposed shoulder harness technical standard order (TSO) that will contain specific design requirements for shoulder harnesses. The FAA will keep the Board informed of progress in these two efforts, and we will provide copies of any NPRM or TSO issued.

A-80-125. Require that those general aviation aircraft manufactured to include attachment points for shoulder harnesses at occupant seats be fitted with shoulder harnesses no later than December 31, 1985, and, in the interim, require this modification as a requisite for change in FAA registration.

FAA Comment. In the shoulder harness retrofit study discussed in our response to recommendation A-77-70, the FAA will assess this scheme for retrofit. Extensive effort is necessary to identify exactly which airplane models have acceptable shoulder harness attachment points. At this time, we do not believe that this retrofit scheme is a fair and equitable scheme since it may impact owners of one type of airplane more severely than owners of another type. This apparent inequity will be assessed in our study, and we will keep the Board informed of significant progress in this area.

A-80-126. Develop, in coordination with airframe manufacturers, detailed, approved installation instructions for installing shoulder harnesses at each seat location in current models and types of general

aviation aircraft in which shoulder harness attachment points were not provided as standard equipment. Publish and provide these instructions to owners of these aircraft by December 31, 1982.

FAA Comment. The FAA, under the Federal Aviation Act of 1958, is not legally empowered to expend government resources in order to develop detailed, approved installation instructions. Nor should the agency be involved in other detailed design of airplanes that it regulates, or publication of instructions provided to airplane owners at the taxpayers' expense. Such design functions are the responsibility of the aircraft type certificate holder or owner. Should the FAA issue a requirement to retrofit shoulder harnesses on airplanes not having attachments, the manufacturers of the airplane will undoubtedly provide an FAA-approved service bulletin accomplishing the installation. We do not believe the provisions of this recommendation are within the scope of FAA's responsibility. Accordingly, we intend to take no further action on Safety Recommendation A-80-126.

A-80-127. Require that those general aviation aircraft for which FAA-approved harness installation instructions have been developed be fitted with shoulder harnesses at each seat location no later than December 31, 1985, and, in the interim, require this modification as a requisite for change in the FAA registration.

FAA Comment. Since the recommendation specifies installation of shoulder harnesses in accordance with FAA-approved instructions prepared under Safety Recommendation A-80-126, the FAA believes this recommendation is also outside the scope of FAA's authority. However, the recommendation is identified as another scheme for retrofitting shoulder harnesses which will be considered in the evaluation discussed in our response to recommendation A-77-70.

A-80-128. At established intervals, extend the application of all newly established occupant protection provisions of 14 CFR 23 to all newly manufactured general aviation aircraft.

FAA Comment. It is not clear to us what occupant protection provisions are referred to in this recommendation. It will be helpful if the Board will identify precisely which paragraphs of Part 23 are referred to in this recommendation for retrofit action, and identify the specific accident or unsafe condition used to conclude that retroactive application of existing rules is necessary. In the absence of a clearly defined unsafe condition, the FAA does not believe that the blanket retroactive application of occupant protection provisions is appropriate. Upon receiving further clarification, the FAA will again consider Safety Recommendation A-80-128.

A-80-129. Revise 14 CFR 23.785(j) to incorporate performance standards and test criteria to insure that an acceptable level of occupant safety is achieved through cabin "delethalization."

FAA Comment. The requirements of Part 23 are intentionally general, thereby providing the desired intent of the regulation which allows the manufacturer freedom to design the airplane as he desires. Advisory material, such as FAA Technical Report No. FS-70-592-120A, has been issued to assist in compliance with the "delethalization" rule. In the area of cabin delethalization, there are many different designs, making it impossible to develop one set of test criteria and performance standards to adequately cover all designs. The requirement for shoulder harnesses in the front seats of general aviation airplanes, we believe, has been highly effective in delethalizing this area of the airplane. The FAA does not believe it is feasible to proceed in accordance with Safety Recommendation A-80-129, because of the broad, general scope of the recommended undertaking. However, we are receptive to any suggestions for specific test criteria or performance standards, and stand ready to evaluate all material presented. Pending more definitive criteria, FAA intends to take no further action on Safety Recommendation A-80-129.

A-80-130. Revise current standards for seat and restraint systems to incorporate needed crashworthiness improvements identified in FAA Research Project reports.

FAA Comment. Again, the FAA concurs with the intent of this recommendation, but we believe more specific information is required regarding which crashworthiness improvements are suggested and, specifically, which regulatory changes are desired. We are sensitive to research projects which result in recommendations that appear technically feasible, but cannot be converted into enforceable regulations because of environmental, cost, or other factors not envisaged during research. The FAA plans no further action on Safety Recommendation A-80-130 pending receipt of more definitive guidelines.

A-80-131. Establish standards for the dynamic testing of occupant protection devices required in general aviation aircraft.

FAA Comment. On June 2, 1975, the Board issued Safety Recommendation A-75-51, recommending that FAR 23.785(f) be revised to require dynamic testing of seats. The FAA has already responded to that recommendation, stating that dynamic testing of seats could not be undertaken until the dynamic load characteristics of the crash are better understood. If dynamic tests are eventually undertaken by the FAA, they, of necessity, would include testing of the seat with a representative occupant fastened to it using the seat belt and shoulder harness, if installed. Thus, dynamic testing of seats would include

dynamic testing of the seat belt and shoulder harness. To our knowledge, these two occupant protection devices are the only devices that need to be tested to a dynamic impact. If we are to understand that the occupant protection devices referred to in this recommendation are the seat belt and shoulder harness, please note that these items will be tested in the course of the dynamic seat tests. If it is suggested that other protection devices be tested, please identify these devices and give us the benefit of your rationale for recommending dynamic testing. In the interim, the FAA intends to continue our research efforts, and we will keep the Board informed of significant progress in this area.

Sincerely,

Original signed by:

Charles E. Weithoner
Administrator-Designate

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: December 31, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-125 through -131

The National Transportation Safety Board recently completed an assessment of the adequacy of occupant protection in general aviation aircraft during a crash. This study was conducted because of the Safety Board's longstanding concern that a majority of serious and fatal injuries which occur annually in these aircraft should be preventable. The Safety Board report reviewed accident investigation findings, crashworthiness research and studies, and the regulatory requirements to assess the adequacy of occupant protection during general aviation crash conditions which should be survivable. 1/

Accident investigation studies since 1943 have found that the primary cause of serious and fatal injuries in general aviation accidents is the unrestrained or partially restrained occupant flailing about within the cabin upon crash impact, striking various portions of his body against objects which penetrate or crush his body structure. This finding of these studies was confirmed by the Federal Aviation Administration's (FAA) 1971 report, "General Aviation Structures Directly Responsible for Trauma in Crash Decelerations." This report found that "in most instances the well-known principles (the packaging principles advocated by H. DeHaven in 1943) have been so grossly ignored that serious and fatal injuries have occurred in anything more severe than a hard landing." This report concluded that the use of properly designed and installed shoulder harnesses would help prevent impact of the head and upper torso—the areas stuck most often during crash conditions.

Research activities of the FAA and others have identified deficiencies in safety belt strength requirements, seat and safety belt anchorage requirements, seat designs, test requirements, and inertial crash deceleration standards. A 1966 FAA report, "Recommendations for Shoulder Harnesses," found that the use of seatbelts alone cannot provide adequate protection to a seated occupant and that there is a critical need for the improvement and use of restraint systems in general aviation aircraft because of documented, significant increases in serious and fatal injuries sustained in potentially survivable accidents.

1/ For more detailed information, read "Safety Report—The Status of General Aviation Aircraft Crashworthiness" (NTSB-SR-80-2), December 17, 1980.

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A 1973 FAA report, "A Summary of Crashworthiness Information for Small Airplanes," provided suggested minimum requirements that would protect occupants during crash decelerations for aircraft designers to consider. Most of the suggested requirements far exceed the FAA's current occupant protection requirements. A 1978 FAA initial project report, "Energy Absorbing Seat Design," reported the deficiencies in present seat requirements as (1) the use of static design and test requirements which do not account for the dynamic conditions under which seats must perform to protect occupants during crash decelerations; (2) the inadequacy of established inertial deceleration standards to provide protection for occupants of survivable crashes; and (3) the lack of standards in 14 CFR 23 for downward inertial forces in general aviation aircraft which do not have retractable landing gear. Many other FAA reports reviewed also identified needs for increased general aviation occupant protection. These reports identified and supported improvements long advocated by the Safety Board. The Safety Board report concluded that the FAA fails to make effective use of available research findings, including its own, to require the implementation of needed crashworthiness improvements for occupants of general aviation aircraft.

The Safety Board's assessment found that the FAA has made little improvement in the general aviation crashworthiness regulations since the 1950 Civil Air Regulations, even though continuing concern has been expressed since 1964 by the Civil Aeronautics Board, the Safety Board, and others. The FAA's 1977 crashworthiness regulatory improvements which required shoulder harnesses for the front seats of all general aviation aircraft manufactured after July 18, 1978, were of very limited scope, as was the requirement for manufacturers of newly certificated general aviation aircraft to eliminate injurious objects within striking radius of each occupant's head and upper torso. These changes provide little occupant crash protection improvement because the delethalization requirement need not be met for currently certificated, newly manufactured aircraft; no criteria have been established against which a manufacturer's delethalization effort is to be measured; and the shoulder harness requirement provides no protection for occupants other than those in the front seats of general aviation aircraft.

On December 17, 1980, the Safety Board reviewed the FAA's actions for accomplishing the safety improvements sought by Recommendation A-77-71 which states:

> Amend 14 CFR 91.33 and .39 to require the installation of approved shoulder harness on all general aviation aircraft manufactured before July 18, 1978, after a reasonable lead time, and at all seat locations as outlined in NPRM [Notice of Proposed Rulemaking] 73-1.

Since this recommendation has been classified as "Open, Unacceptable Action" for 3 years, the Safety Board developed recommendations to specify a date certain by which the FAA should accomplish the safety objectives of Recommendation A-77-71 and included them as new recommendations.

As a result of its review of general aviation aircraft crashworthiness, the National Transportation Safety Board reiterates its Recommendation Nos. CY-70-42, Part 4, and A-77-70 which state:

CY-70-42, Part 4:

[Initiate] regulatory action . . . to raise the "minor crash landing" inertia forces of [14 CFR] 23.561 to a level comparable to those produced by a moderate-to-severe crash landing. Until a reasonable crash design condition is decided upon, including a specified crash acceleration pulse, it is suggested that the longitudinal inertia force be raised to 20 to 25 and the forces about other axes be similarly increased. (Recommendation Status: Previously closed when the FAA issued an NPRM whose requirements, if made final, would have accomplished the recommended action.)

A-77-70

Amend 14 CFR 23.785 to require installation of approved shoulder harnesses at all seat locations as outlined in NPRM 73-1. (Recommendation Status: Open, Unacceptable Action)

Additionally, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Require that those general aviation aircraft manufactured to include attachment points for shoulder harnesses at occupant seats be fitted with shoulder harnesses no later than December 31, 1985, and, in the interim, require this modification as a requisite for change in FAA registration. (Class II, Priority Action) (A-80-125)

Develop, in coordination with airframe manufacturers, detailed, approved installation instructions for installing shoulder harnesses at each seat location in current models and types of general aviation aircraft in which shoulder harness attachment points were not provided as standard equipment. Publish and provide these instructions to owners of these aircraft by December 31, 1982. (Class II, Priority Action) (A-80-126)

Require that those general aviation aircraft for which FAA-approved harness installation instructions have been developed be fitted with shoulder harnesses at each seat location no later than December 31, 1985, and, in the interim, require this modification as a requisite for change in the FAA registration. (Class II, Priority Action) (A-80-127)

At established intervals, extend the application of all newly established occupant protection provisions of 14 CFR 23 to all newly manufactured general aviation aircraft. (Class II, Priority Action) (A-80-128)

Revise 14 CFR 23.785(j) to incorporate performance standards and test criteria to insure that an acceptable level of occupant safety is achieved through cabin "delethalization." (Class II, Priority Action) (A-80-129)

Revise current standards for seat and restraint systems to incorporate needed crashworthiness improvements identified in FAA Research Project reports. (Class II, Priority Action) (A-80-130)

Establish standards for the dynamic testing of occupant protection devices required in general aviation aircraft. (Class II, Priority Action) (A-80-131)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

For By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

April 7, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-132 through A-80-138 issued by the Board on January 5, 1981. These recommendations resulted from the Board's investigation of the crash of an Air Wisconsin, Inc., Swearingen SA-226 Metro on June 12, 1980, near Valley, Nebraska.

In addition to the seven new Safety Recommendations generated by this accident, the Board also reiterated four pending recommendations, which were included as a part of this Safety Recommendation package. Those previously issued recommendations are A-75-51, A-77-63, A-77-68, and A-78-1.

The Federal Aviation Administration (FAA) is responding separately to Safety Recommendations A-75-51, A-77-63, and A-78-1. Our responses to these three recommendations are currently in the internal coordination process and should be in the Board in the immediate future.

Therefore, this letter responds to Safety Recommendations A-77-68 and A-80-132 through A-80-138.

<u>A-77-68</u>. Formulate rules and procedures for the timely dissemination by air traffic controllers of all available severe weather information to inbound and outbound flightcrews in the terminal area.

<u>FAA Comment</u>. On August 13, 1980, we responded to this recommendation by stating that a task group was addressing the problem of disseminating weather data in terminal locations. The recommendation of this group resulted in activating a Center Weather Service Unit (CWSU) in 13 of our Air Route Traffic Control Centers (ARTCC) in April of 1978. We then informed the Board that by October of 1980 we expected that our planned total of 21 of these CWSU's in the 20 ARTCC's in the contiguous 48 states and in the Anchorage, Alaska, ARTCC would be operational.

Currently, the FAA has all 21 CWSU's in place and operational with procedures established to disseminate weather intelligence to terminal facilities within the ARTCC's area of responsibility.

Additionally, we have, in progress, two programs designed to provide a more timely method of weather dissemination. The first, a touchmatic conference call system, will be installed at the Indianapolis ARTCC in the second quarter of 1981. This system will allow intra/interconference capability to facilities/positions requiring weather information. After testing is completed, in the third quarter of 1981, a decision will be made concerning national implementation of this system. The other program involves an R&D effort for a system that will decrease dissemination time and also provide a hard copy or pictorial of pertinent weather. A final report on this effort will be completed early this spring.

In the interim, we have authorized all regions to supplement Handbook 7210.2, paragraphs 820c and 1220b, significant meteorological information (SIGMET) dissemination, when the sharing of some SIGMET responsibility to other air traffic facilities would assist in a more timely dissemination of SIGMET's. We have also tasked the regions to review their respective center SIGMET dissemination procedures for ways to reduce delays and to ensure the timely distribution of SIGMET information.

We believe these efforts are fully responsive to Safety Recommendation A-77-68. Accordingly, the FAA considers action on this recommendation completed.

A-80-132. Undertake an experimental program to analyze and evaluate the technical and operational feasibility of requiring that air traffic control provide separation between aircraft and severe meteorological conditions when the nature and location of the meteorological conditions can be determined.

FAA Comment. The FAA does not concur in this recommendation. The key issue is whether the pilot-in-command or the air traffic controller is more qualified to make decisions concerning hazardous weather avoidance. All of the information we have derived from experience, user input, and meteorological state-of-the-art, indicates conclusively that the final decisionmaking authority (concerning weather avoidance) should rest with the pilot-in-command.

The FAA will continue its effort to upgrade the quality and timeliness of weather information that we provide to pilots. However, our dedicated involvement in weather-related activities has provided no evidence indicating that transfer of the decisionmaking authority, from pilot to controller, is warranted or would, in any way, increase safety. Accordingly, the FAA intends to take no further action on Safety Recommendation A-80-132.

A-80-133. Review the relationship and duties of ARTCC team supervisors to flow controllers/weather coordinators to insure that the nature of each job function is understood and accomplished.

FAA Comment. The FAA concurs in this recommendation. The ARTCC team supervisor and flow controller/weather coordinator work under the supervision of the assistant chief and perform duties in accordance with policies, regulations, laws, and procedures. Some of the related duties of the team supervisor and flow controller/weather coordinator, as they pertain to specific events surrounding the subject accident, are as follows:

Team Supervisor:

Monitors operation, making timely and reasonable decisions concerning equipment, traffic flow, weather, and configuration.

Makes operational adjustments based on traffic flow and weather.

Solicits information to ensure a complete briefing from other supervisors when relieving them.

Provides controllers with pertinent information in a timely manner.

Provides pertinent information in a timely manner to persons, sectors, and facilities affected by his operation.

Flow Controller/Weather Coordinator:

Develops and initiates flow control procedures as required between intracenter areas and between adjacent en route facilities.

Maintains a continuous awareness of the traffic flow, status of NAVAIDS, weather conditions, and traffic forecasts to preclude situations which would cause flight within undesirable atmospheric conditions.

Maintains continuous liaison with major terminal, adjacent centers, CWSU and/or Weather Service Forecast Office, and central flow control facility to keep current on actual and anticipated traffic volume, weather, and operating conditions.

Disseminates all weather intelligence which is determined to be of significance to the Assistant Chief in charge, flow controllers, area supervisors, sectors, and appropriate Air Traffic Control (ATC) facilities.

In our judgment, the duties of the ARTCC team supervisor and the flow controller/weather coordinator are well defined. We believe, however, that the relationship can be enhanced by improving the communications and training of CWSU personnel (meteorologist, flow controller/weather coordinator). Accordingly, the FAA has submitted a training proposal to the FAA Academy for the development of a study package for the CWSU meteorologists. This training package should enhance the meteorologist's understanding of the ATC system and how it works, provide for better communication with ATC personnel using the language of the ATC system, and increase his understanding of the effects of weather on the ATC system.

Moreover, we are testing the feasibility of whether a different approach to teaching the Flow Management/Weather Coordinator Course (CRS #50112), which is currently being conducted at the FAA Academy, is desirable. We may decide to conduct the course regionally and on-site so as to make the course more readily available to a greater number of personnel, provide a means of recurrent training, and reduce regional expenditures in personnel attending the present course. The validation period for this test begins in February and will continue through December 1981. We believe these efforts are fully responsive to Safety Recommendation A-80-133. Accordingly, the FAA considers action on this recommendation completed.

A-80-134. Require that the subject accident report be reviewed by air traffic control specialists and supervisors.

FAA Comment. The FAA concurs in this recommendation. All FAA regions have been tasked to ensure that ATC specialists and area supervisors review NTSB Accident Report 80-15. Regions will forward completion of this requirement to AAT-300 no later than June 15. A copy of our communication to regional air traffic divisions is enclosed. The FAA considers action on Safety Recommendation A-80-134 completed.

A-80-135. Require that flow controllers and supervisory personnel assess the potential effects of hazardous weather on low-altitude en route traffic and use the evaluation to adjust air traffic flow as necessary.

FAA Comment. The FAA concurs in this recommendation. It is the responsibility of the flow controller to assess the potential effects of hazardous weather on all en route traffic within the ARTCC's airspace. The team supervisor is charged with the same responsibility within his area of jurisdiction. They act jointly to preclude situations that could result in flight within atmospheric conditions detrimental to the expeditious flow of traffic. We have tasked our FAA regions with a

requirement to place special emphasis on flow controller, meteorologists and supervisory responsibilities concerning the assessment of the effect of hazardous weather on low-altitude en route traffic. The FAA considers action on Safety Recommendation A-80-135 completed.

A-80-136. Require that the effect of precipitation-induced attenuation, on X-band airborne weather radar be incorporated into airline training programs and that airborne weather radar manufacturers include attentuation data in radar operators handbook.

FAA Comment. The FAA concurs in this recommendation. In response to Safety Recommendation A-80-136, we are in the process of revising Air Carrier Operations Bulletin No. 7-79-3, Airborne Weather Radar. In this revision we have further stressed the importance of operator knowledge of the effect of precipitation-induced attenuation on X-band airborne weather radar. We believe this effort is fully responsive to Safety Recommendation A-80-136. Accordingly, the FAA considers action completed on this recommendation.

A-80-137. Amend 14 CFR 23.807, Emergency Exits, to require all emergency exits on Part 23 air taxi and commuter aircraft with a capacity of 10 or more passenger seats manufactured after a specified date to be installed so that each could be opened from outside the aircraft.

FAA Comment. The FAA does not concur in this recommendation. Since Part 23 presently applies to airplanes with a passenger seating capacity of 9 passengers or less, a change to FAR 23.807, as suggested, would not accomplish the intent of the Board's recommendation. Part 25, which applies to airplanes with 10 or more passenger seats, already requires that each emergency exit be designed so as to be opened from the outside.

The recommendation to require that all emergency exits be configured so as to be opened from the outside on air taxi and commuter airplanes with a capacity of 10 or more passenger seats, placed in service after a specified date, could be accomplished by a revision to Part 135. The FAA is unaware, though, of any accidents wherein the inability to open emergency exits from the outside has cost lives that otherwise might have been saved. It must be recognized that retroactive application of such a rule to inservice/new production aircraft could prove very costly, and a thorough safety benefits vs. cost analysis would be required. Accordingly, the FAA intends to take no further action on Safety Recommendation A-80-137.

A-80-138. Evaluate procedures which govern the transmission of SIGMET's on navaids to determine what additional steps are necessary to provide timely dissemination, and take necessary corrective measures to insure that they are issued according to the procedures.

FAA Comment. The FAA concurs in this recommendation. Each FAA region will be required to have its Flight Service Station facility personnel review the applicable broadcast and facility directives to ensure that each specialist is aware of the importance of broadcasting hazardous weather advisories. Additionally, each region is being requested to review the accident report and make recommendations on the most appropriate priority of duties. We expect this regional review and evaluation to be completed by June 15, 1981. The FAA considers action completed on Safety Recommendation A-80-138.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: January 5, 1981

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-132 through -138

On June 12, 1980, an Air Wisconsin, Inc., Swearingen SA-226 Metro crashed near Valley, Nebraska, killing 13 persons and seriously injuring 2 others. The aircraft encountered an area of severe thunderstorms while at an altitude of less than 6,000 ft and experienced a simultaneous loss of power to both engines because of massive water ingestion. During its investigation of the accident, the National Transportation Safety Board found numerous deficiencies in the implementation of air traffic control procedures which affected the acquisition of weather data and the dissemination of that information to sector air traffic controllers and pilots. The Safety Board also discovered that the capabilities of airborne weather radar on the aircraft to detect severe weather echoes were limited significantly by rain-induced two-way attenuation, but that the pilots were probably not aware of the reduced capability of the radar.

The thunderstorm activity had been in the vicinity of the accident site for several hours, and a severe storm warning had been issued for the Omaha area. The meteorologists in the Minneapolis Air Route Traffic Control Center (ARTCC) had alerted supervisory air traffic control personnel of the severity of the weather conditions at various times before the accident; however, that information was not disseminated to the controllers or to the flightcrew. Furthermore, the two team supervisors and the two flow control/weather coordinators did not determine if the severe weather was affecting the air traffic in the low-altitude sectors, although the flow controllers had acknowledged that the high-altitude traffic was rerouted because of the thunderstorms.

The Safety Board is concerned since adequate personnel, procedures, and units were available to provide adequate ATC services to the flightcrew. However, the weather information that was critical to the sector controllers was not passed by the ATC supervisors, who assumed that other supervisors had passed the information along. In addition, the four supervisors were not in agreement regarding the responsibilities for assessing the impact of severe meteorological conditions on low-altitude air traffic flow. Finally, one weather coordinator indicated that he was not trained properly to fulfill the weather coordinator duties.

3009A

The aircraft separation requirements of the ATC system were also examined during the investigation. Controllers and air traffic control supervisors testified at the public hearing that the air traffic system was not required to separate aircraft from hazardous weather conditions. The Safety Board agrees that the avoidance of hazardous weather conditions is a pilot responsibility. However, the future ATC system should consider the feasibility of actively separating aircraft from known meteorological conditions when adequate weather intelligence exists. We urge the Federal Aviation Administration to undertake an experimental program to analyze and evaluate the technical and operational feasibility of the ATC system providing separation between aircraft from severe meteorological conditions.

The Safety Board is also concerned by the limitations of airborne weather radar. Testimony at the public hearing indicated that the capability of the aircraft radar was limited severely by rain-induced two-way attenuation. Based on the circumstances existing at the time of the accident, the attenuation limited the range of the radar set in contour mode to about 15 miles in moderate rainfall and to about 1 mile in heavy precipitation. Consequently, the flightcrew, which probably depended on the airborne radar to avoid the strongest weather echoes, had no way to determine the location or the intensity of the weather echoes ahead of the aircraft until they were too close to avoid the hazardous conditions. The Safety Board believes that further study on the effects of attenuation is required and that airline and general aviation training programs must be changed to provide additional information to pilots about the effects of attenuation on X-band airborne weather radar.

Finally, the investigation revealed that the aircraft emergency exits were not installed so they could be opened from outside the aircraft by rescuers. Immediate access to the passenger cabin was available through the rear pressure bulkhead and breaks in the fuselage. However, if rapid access had been necessary, the lack of adequate markings and opening mechanisms would have hampered rescuers.

Therefore, the National Transportation Safety Board reiterates the following safety recommendations:

ATF

> Amend 14 CFR 23.785(f) to require dynamic testing of seats to insure more realistic protection of occupants from serious injury in a minor crash. (Class III, Longer Term Action) (A-75-51)

NWS

> Expedite the development and implementation of an aviation weather subsystem for both en route and terminal area environments, which is capable of providing a real-time display of either precipitation or turbulence, or both, and which includes a multiple-intensity classification scheme. Transmit this information to pilots either via the controller as a safety advisory or via an electronic data link. (Class II, Priority Action) (A-77-63)

NWS

> Formulate rules and procedures for the timely dissemination by air traffic controllers of all available severe weather information to inbound and outbound flightcrews in the terminal area. (Class II, Priority Action) (A-77-68)

NIF

> Initiate research to determine the attenuating effects of various levels of precipitation and icing on airborne radomes of both X- and C-band radar, and disseminate to the aviation community any data derived concerning the limitations of airborne radar in precipitation. (Class II, Priority Action) (A-78-1)

As a further result of this investigation, the National Transportation Safety Board recommends that the Federal Aviation Administration:

ATF Undertake an experimental program to analyze and evaluate the technical and operational feasibility of requiring that air traffic control provide separation between aircraft and severe meteorological conditions when the nature and location of the meteorological conditions can be determined. (Class III, Longer Term Action) (A-80-132)

ATF Review the relationship and duties of ARTCC team supervisors to flow controllers/weather coordinators to insure that the nature of each job function is understood and accomplished. (Class III, Longer Term Action) (A-80-133)

ATF Require that the subject accident report be reviewed by air traffic control specialists and supervisors. (Class III, Longer Term Action) (A-80-134)

ATF Require that flow controllers and supervisory personnel assess the potential effects of hazardous weather on low-altitude en route traffic and use the evaluation to adjust air traffic flow as necessary. (Class II, Priority Action) (A-80-135)

NFO Require that the effect of precipitation-induced attenuation on X-band airborne weather radar be incorporated into airline training programs and that airborne weather radar manufacturers include attenuation data in radar operators handbooks. (Class II, Priority Action) (A-80-136)

AWS Amend 14 CFR 23.807, Emergency Exits, to require all emergency exits on Part 23 air taxi and commuter aircraft with a capacity of 10 or more passenger seats manufactured after a specified date to be installed so that each could be opened from outside the aircraft. (Class III, Longer Term Action) (A-80-137)

ATF Evaluate procedures which govern the transmission of SIGMET's on navaids to determine what additional steps are necessary to provide timely dissemination, and take necessary corrective measures to insure that they are issued according to the procedures. (Class II, Priority Action) (A-80-138)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

JUN - 5

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Please refer to the National Transportation Safety Board's Safety Recommendation A-80-142 issued January 15, 1981. This recommendation stemmed from our investigation of a Beechcraft Model C45H accident near Hastings, Michigan, on September 15, 1979. We recommended that the Federal Aviation Administration (FAA) issue an Airworthiness Directive (AD) to require periodic inspection of Stewart-Warner heaters, similar to AD 80-09-10 which applies to Janitrol heaters.

We are pleased to see on pages 24936 and 24937 of the Federal Register, Volume 46, No. 85, dated May 4, 1981, that the FAA has issued a new AD based on the Safety Board's recommendation. Recommendation A-80-142 is now classified in a "Closed--Acceptable Action" status.

We thank the FAA for actions taken.

Sincerely yours,

James B. King
Chairman

Office of the Chairman

National Transportation Safety Board

Washington, D.C. 20594

May 18, 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Reference is made to the Federal Aviation Administration's (FAA) letter dated April 1, 1981, responding to National Transportation Safety Board Safety Recommendation A-80-142 issued January 15, 1981. This recommendation stemmed from the Safety Board's investigation of a Beechcraft Model C45H accident near Hastings, Michigan, on September 15, 1979. We recommended that the FAA issue an Airworthiness Directive (AD) to require periodic inspection of Stewart-Warner heaters, similar to AD 80-09-10 which applies to Janitrol heaters.

We are pleased to note that the FAA concurs with this recommendation and will issue an AD requiring inspections and overhaul as outlined in Stewart-Warner manuals. Pending the issuance of the AD, the status of this recommendation is classified "Open--Acceptable Action."

We thank the FAA for actions taken and underway.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 1, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-80-142 issued by the Board on January 15, 1981. This recommendation resulted from the Board's investigation of the crash of a Beechcraft Model C45H, N600NA, on September 15, 1979, near Hastings, Michigan.

A-80-142. Issue an Airworthiness Directive (AD) to require periodic inspection of Stewart-Warner heaters, similar to AD 80-09-10 which applies to Janitrol heaters.

FAA Comment. The Federal Aviation Administration (FAA) concurs in Safety Recommendation A-80-142. FAA's Great Lakes Region will issue an Airworthiness Directive (Final Rule) requiring inspections and overhaul as outlined in Stewart-Warner service manuals. We expect this AD to be issued by April 3, 1981, and a copy will be made available to the Board upon publication. With issuance of the AD, the FAA considers action completed on Safety Recommendation A-80-142.

Sincerely,

Charles E. Weithoner
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: January 15, 1981

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-142

On September 15, 1979, a Beechcraft Model C45H, N600NA, crashed while on a ferry flight from Baltimore, Maryland, to Grand Rapids, Michigan. When the aircraft was about 10 miles southeast of Hastings, Michigan, the pilot reported an engine fire. He was informed that the Hastings Municipal airport was about 10 miles straight ahead, and the pilot indicated that he would land there. The pilot then transmitted "the flaps are on fire," followed by "the whole engine is on fire." There were no further communications with the aircraft. The aircraft crashed about 6 miles short of the airport and burned. The pilot and three nonrevenue passengers were fatally injured.

The National Transportation Safety Board's investigation revealed that the in-flight fire was concentrated in the left wheel well area, aft of the engine firewall. The aircraft's left heater and left combustion air blower, located in the left wheel well area, had separated at impact. They were found clear of other pieces of wreckage and outside the ground fire area. The stainless steel heater shroud was dark blue in several areas, which is indicative of exposure to temperatures of about 2,000° F.

The heater was disassembled and the following items noted:

1. The combustion air orifice was about halfway open, indicating that the heater was in operation.

2. There was soot in the combustion air chamber behind the fuel nozzle.

3. The fuel valve seat was cracked in two places.

4. The ignitor was corroded.

5. The gasket between the burner assembly and the heat exchanger was burned through and showed evidence of leakage before the accident.

3115

The aircraft records indicated that the heater, a Stewart-Warner Model 8253A, had been installed in 1965. The operator's maintenance service manager stated there was no mechanical device nor were there any logbook entries to record hours of heater operation. The aircraft had flown about 2,900 hours since the heater was installed. The manufacturer recommends that the heater be inspected at 250-hour intervals and overhauled after 1,000 hours of operation. The aircraft records did not reveal that any of the heater manufacturer's recommended inspections had been performed.

Although the probable cause of this accident has not yet been determined, the Safety Board is concerned that there were numerous discrepancies noted during examination of the heater and that none of the manufacturer's recommended inspections had been accomplished since the heater was installed in 1965.

The Safety Board is aware that the Federal Aviation Administration recently issued AD 80-09-10 which applies to Janitrol heaters. This AD was issued as a result of an aircraft fire which originated from the combustion heater. The FAA determined that insufficient heater inspections, especially of the combustion liner, have allowed the condition of Janitrol combustion heaters to deteriorate to a level where heater malfunctioning can cause serious safety problems.

We believe this accident demonstrates a need for a similar Airworthiness Directive applicable to Stewart-Warner heaters. Accordingly, the Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive (AD) to require periodic inspection of Stewart-Warner heaters, similar to AD 80-09-10 which applies to Janitrol heaters. (Class II, Priority Action) (A-80-142)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

By: James B. King
for Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

This is to acknowledge the Federal Aviation Administration's (FAA) letter of April 6, 1981, responding to National Transportation Safety Board Safety Recommendations A-81-6 and -7 issued January 15, 1981. These recommendations stemmed from our examination of aircraft accident data pertaining to throttle linkage separation in single engine aircraft. Our records indicate that between 1964 and 1979 there were 148 accidents initiated by throttle linkage failures.

In Safety Recommendation A-81-6 we proposed that the FAA:

> Establish a requirement that, when throttle linkage separation occurs in a small single engine aircraft the fuel control will go to a setting which will allow the pilot to maintain level flight in the cruise configuration.

We are pleased to note that the FAA plans to complete a study soon and will inform the Safety Board of its findings. Safety Recommendation A-81-6 is maintained in an "Open--Acceptable Action" status.

In Safety Recommendation A-81-7 we requested the FAA to:

> Review the service experience of throttle linkage separations in single engine general aviation aircraft and issue an Airworthiness Alert to the owners and operators of such aircraft, to increase their awareness of the problems associated with such linkage separations. The alert should be worded to improve maintenance practices and inspection techniques.

We have examined the material relating to throttle linkage separation published in the April 1981 issue of Advisory Circular 43-16, General Aviation Maintenance Alerts. We trust that this will lead to improved maintenance practices and inspection techniques. The status of this recommendation is classified as "Closed--Acceptable Action."

We thank the FAA for actions taken and ongoing.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 6, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-81-6 and A-81-7 issued by the Board on January 15, 1981. These recommendations resulted from the Board's investigation of engine failures in general aviation aircraft as the result of throttle linkage separation.

A-81-6. Establish a requirement that, when throttle linkage separation occurs in a small single engine aircraft the fuel control will go to a setting which will allow the pilot to maintain level flight in the cruise configuration.

FAA Comment. The Federal Aviation Administration (FAA) currently has this recommendation under study in view of the variable conditions that could determine the safe throttle position if linkage separation occurs; e.g., aircraft configuration, loading, flight phase, altitude, terrain, etc. In this regard, it is noted that automatic fuel control positioning is incorporated in Cessna Model 188 and A188 aircraft at the full throttle position in consideration of the typical operating environment of these aircraft. We expect to complete our study by April 30, 1981, and we will make the Board aware of our findings at that time.

A-81-7. Review the service experience of throttle linkage separations in single engine general aviation aircraft and issue an Airworthiness Alert to the owners and operators of such aircraft, to increase their awareness of the problems associated with such linkage separations. The alert should be worded to improve maintenance practices and inspection techniques.

FAA Comment. Since the inception of Advisory Circular 43-16, General Aviation Maintenance Alerts, approximately 20 articles have been published dealing with the subjects of throttle controls and throttle control disconnects. An additional item emphasizing this fact and the need for critical attention to the conditions of throttle control linkage has been published in the April 1981 issue of AC 43-16 (advance copy enclosed).

We believe this additional publication satisfies the intent of Safety Recommendation A-81-7 and, accordingly, the FAA considers action completed on this recommendation.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: January 15, 1981

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-6 and -7

The National Transportation Safety Board's aircraft accident data indicate that engine failures are a substantial initiating factor in general aviation accidents. One problem associated with engine failures is the separation of the throttle linkage. The results of these separations vary among models of aircraft; the variations include the fuel control commanding one of three settings: idle power, full power, or shutoff (no power) position.

Our records indicate that between 1964 and 1979 there were 148 reports of single-engine aircraft accidents initiated by throttle linkage failures. These accidents resulted in 5 deaths, 250 injuries, 15 destroyed aircraft, and 133 substantially damaged aircraft. The Safety Board believes that this type of accident can be reduced and that aggressive preventive action is needed.

A typical example of this kind of accident involved a Cessna 207 which was climbing in VFR conditions. Shortly after the flight was cleared to climb and to maintain 5,000 feet, the engine quit. The pilot could not return to the airport because the engine had stopped, so he landed the aircraft on a partially lighted city street. During the landing roll, the aircraft struck signs on both sides of the street when the pilot attempted to avoid automobile traffic. The aircraft received substantial damage, but the pilot escaped injury. Our investigation disclosed that the throttle linkage had separated. During the investigation the engine was started by operating the throttle control at the injector manually, and the engine operated normally at all speeds from idle to maximum power. When the throttle control was released, the engine immediately returned to idle and quit.

This mishap is representative of many accidents and incidents which evolve in approximately the same manner each year. The Safety Board's data indicate that this type of accident is increasing. Our investigations indicate that the causes of throttle linkage separation include such factors as design, maintenance and inspection practices, improper maintenance procedures, improper operation of powerplant controls, and inadequate preflight inspections.

3139

In existing aircraft, when the throttle linkage separates, one of the following three things happens: the throttle closes and the engine idles or stops; the throttle remains at the power set at the time of failure; or the throttle goes to the full open position. If the throttle closes and the engine idles or quits, the pilot is committed to land without regard for weather or proximity to a suitable landing area. We believe this condition is unsatisfactory.

If the throttle goes to the full open position after linkage separation, the pilot has a different problem. It may be difficult to descend at a safe speed, particularly at night or in IFR conditions. This problem can be compounded when the available maneuvering area is restricted by terrain or other obstacles. It may take more than ordinary piloting ability to maintain control of an aircraft and its speed under those conditions.

The third condition--power remaining at the selected setting when separation occurs--is the best of the three in most cases. However, if the extremes of idle power for descent or maximum power for takeoff exist when separation occurs, the problems would be the same as those associated with the other two conditions.

Considering these factors, we believe that the safest solution to this problem would be to establish a requirement that, when throttle linkage separation occurs, the fuel control would automatically travel to a setting which would allow the pilot to maintain level flight in a cruise configuration.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Establish a requirement that, when throttle linkage separation occurs in a small single engine aircraft the fuel control will go to a setting which will allow the pilot to maintain level flight in the cruise configuration. (Class II, Priority Action) (A-81-6)
>
> Review the service experience of throttle linkage separations in single engine general aviation aircraft and issue an Airworthiness Alert to the owners and operators of such aircraft, to increase their awareness of the problems associated with such linkage separations. The alert should be worded to improve maintenance practices and inspection techniques. (Class II, Priority Action) (A-81-7)

KING, Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations. DRIVER, Vice Chairman, did not participate.

James B. King

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

This is to acknowledge Federal Aviation Administration (FAA) letter dated March 27, 1981, responding to National Transportation Safety Board Safety Recommendation A-81-8 issued January 28, 1981. This recommendation stemmed from our investigation of a Beech Kingair 200 accident near Denver, Colorado, on March 27, 1980. We recommended that the FAA:

> "Develop and implement a priority message-handling procedure to assure the immediate delivery of urgent weather messages to all weather circuits that originate from the Weather Message Switching Center in Kansas City, Missouri."

The Safety Board is pleased to note that the FAA has initiated action to fulfill this recommendation and will keep us informed of significant progress. A-81-8 is classified in an "Open--Acceptable Action" status. We thank the FAA for actions taken and ongoing.

Sincerely yours,

James B. King
James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

March 27, 1981

The Honorable James B. King
Chairman, National Transportation
  Safety Board
800 Independence Avenue, SW.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-81-8 issued by the Board on January 28, 1981. This recommendation resulted from the Board's investigation of the crash of a Beech Kingair 200, N456L, on March 27, 1980, 14 miles southeast of the Arapahoe County Airport, Englewood, Colorado.

A-81-8. Develop and implement a priority message-handling procedure to assure the immediate delivery of urgent weather messages to all weather circuits that originate from the Weather Message Switching Center in Kansas City, Missouri.

FAA Comment. The Federal Aviation Administration (FAA) has already initiated efforts in this area based on our own requirements and recognition of inadequate capacity. Our Weather Message Switching Center (WMSC) has already been tasked with modifying and expanding its "Urgent Routing" capabilities. These changes will include immediate dissemination on all appropriate circuits. We hope to finish this project during the first quarter of 1982, but ultimate completion of this task is dependent on the expansion of core memory in our WMSC processors. This expanded capacity is scheduled to take place in the last quarter of CY 81.

We will keep the Board informed of significant progress in this area as our program continues.

Sincerely,

Charles E. Weithoner
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: January 28, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-8

On March 27, 1980, the National Transportation Safety Board investigated an accident near Denver, Colorado, involving a Beech Kingair 200, N456L. The aircraft departed Arapahoe County Airport, Englewood, Colorado, at 1432 mountain standard time on an instrument flight rules (IFR) flight plan to Lufkin, Texas. About 7 minutes after takeoff at an altitude of about 12,800 feet, the pilot reported to Denver departure control that the aircraft was encountering icing and requested a return to the Arapahoe County Airport.

Shortly thereafter, the pilot stated that he wanted to go to Stapleton International Airport rather than Arapahoe. The aircraft was cleared to 11,000 feet, but the pilot radioed that the aircraft was not able to maintain altitude. About this time, the Denver radar controller offered the pilot of N456L a precision approach radar (PAR) approach to the Buckley Air National Guard Base. The aircraft was not able to reach Buckley and crashed in an open field about 14 miles southeast of the Arapahoe County Airport. There were 10 fatalities.

The pilot of N456L called the Denver Flight Service Station (FSS) at 1020 and requested a weather briefing for a proposed flight from Arapahoe County Airport to Lufkin, Texas, departing at 1330. The weather briefing lasted from 1020 to 1024.

The Safety Board's investigation of the accident disclosed that the lack of priority message handling on the leased service-A high-speed weather data circuit, which serves the Denver FSS, resulted in the omission of an urgent weather message, SIGMET GOLF 1, calling for severe icing in eastern Colorado, from the weather briefing at 1020.

Priority message handling exists only on the low-speed, service-A circuits that originate at the Weather Message Switching Center (WMSC) in Kansas City, Missouri. Therefore, SIGMET GOLF 1 was available over the low-speed, service-A weather data circuit at 1011, 1 minute after it was issued by the National Weather Service (NWS). However, there is no priority message-handling procedure for the leased high-speed service-A weather data circuit, and SIGMET GOLF 1 was not available to the Denver FSS specialist responsible for aviation weather briefings until 1025--too late to include in the briefing of the pilot of N456L. Although both weather data circuits serve the Denver FSS, the leased service-A circuit is used primarily for receiving weather data necessary for weather briefings; the low-speed, service-A circuit serves as a backup.

3141

The leased high-speed, service-A circuit serves not only the Denver FSS but also more than 140 other flight service stations nationwide. In addition, medium- and high-speed weather data circuits that originate at the WMSC at Kansas City serve the meteorological departments of many of the major air carriers as well as other nongovernment users engaged in aviation forecasting and weather briefing.

Urgent weather messages contain information pertaining to the safety of all aircraft. Information contained in these messages must be made available immediately to the aviation community. To do so requires the immediate delivery of urgent weather messages to all weather data circuits that originate from the WMSC.

The Safety Board is aware that the Federal Aviation Administration (FAA) on April 14, 1980, made a temporary format change in the delivery of urgent weather messages to the leased high-speed, service-A weather data circuit. The change provides for the immediate delivery of urgent weather messages to the FSS supervisor's printer. This information is then disseminated by the supervisor to FSS specialists responsible for weather briefings. This format change only affects those flight service stations on the leased service-A circuit and does not affect nongovernment users on other medium- and high-speed circuits. The Safety Board believes that, in the interest of air safety, immediate delivery of urgent weather messages to all circuits that originate at the WMSC at Kansas City is necessary.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Develop and implement a priority message-handling procedure to assure the immediate delivery of urgent weather messages to all weather circuits that originate from the Weather Message Switching Center in Kansas City, Missouri. (Class II, Priority Action) (A-81-8)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

James B. King

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 1, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-81-9 through A-81-11 issued by the Board on February 6, 1981. These recommendations resulted from the Board's investigation of the crash of a Cessna 207A, N6424H, at Merrill Field, Anchorage, Alaska, on October 8, 1979.

A-81-9. Expand 14 CFR 139 to include minimum specifications and design criteria for the installation, maintenance, and inspection of aviation fuel storage and dispensing systems at airports certificated under 14 CFR 139.

FAA Comment. An advisory circular (AC) is being developed which will address the subjects of delivery of aviation fuel to airports, storage, handling and dispensing of fuel to aircraft, and the area of fuel contamination. A number of required changes will be incorporated in 14 CFR 139, which is being rewritten at this time. The above mentioned AC will be incorporated into the rule as a referenced standard.

A-81-10. Take necessary action to establish minimum specifications and design criteria for aviation fuel storage and dispensing systems at public-use airports not certified under 14 CFR 139. In addition to the equipment itself, such criteria should address their installation, operation, maintenance, and inspection.

A-81-11. When specifications and criteria are established for aviation fuel storage and dispensing systems at public-use airports are not certified under 14 CFR 139, establish and implement procedures to verify compliance.

FAA Comment. After publication, the above-referenced AC will be available as guidance to all airport operators. Aviation petroleum suppliers, consulting engineering firms, and other organizations, such

as the National Fire Protection Association, normally provide specifications for aviation fuel storage and dispensing systems. This information is readily available. At the present time, there is no regulatory requirement for other than air carrier airports to be subject to fuel inspections under the provisions of 14 CFR 139. In order for other than air carrier airport fueling facilities to be inspected, it would be necessary that appropriate legislation be enacted providing the agency with the statutory authority to promulgate rules covering safety requirements on all public-use airports.

We will keep the Board informed of our continuing efforts in this area.

Sincerely,

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 6, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-9 through -11

On October 8, 1979, a Cessna 207A, N6424H, crashed into a hangar at Merrill Field, Anchorage, Alaska, moments after lift-off from runway 33. All four occupants were killed, and the postcrash fire destroyed the hangar.

Investigation of the accident revealed that: the fuel system showed evidence of extensive water and rust contamination; the underground fuel tank at Merrill Field where the aircraft was last fueled contained a large quantity of water and rust; the underground fuel tank's filtration system was heavily contaminated; and an incorrect fuel system dispensing filter, intended for use with diesel fuel, had been installed.

In 1978, the National Transportation Safety Board investigated 17 general aviation accidents involving fuel contamination "exclusive" of water as a cause or factor, and 66 general aviation accidents involving water "in" the fuel as a cause or factor. In March 1980, the Safety Board's Anchorage field office mailed a questionnaire to all known commercial/air taxi operators in the State of Alaska. Of the operators who replied, 4 percent did not know what type of filtration assemblies and filters they used, 4 percent performed no inspections to determine when the dispensing filters should be changed, 30 percent inspected the dispensing filter daily, and 20 percent inspected the dispensing filter "at least yearly." The remaining operators inspected at intervals ranging from "once every 3 days" to "once every 3 years."

The Safety Board recognizes that the pilot is responsible for assuring that a general aviation aircraft has uncontaminated fuel. Pilots of general aviation aircraft procedurally drain a small amount of fuel from the tanks and the fuel strainer and check for the presence of water and particulate matter. If a partially filled tank cools, condensation results and settles to the bottom of the tank. This is detectable using normal preflight procedures.

3145

However, when fuel contaminated by water is added to an uncontaminated tank, considerable time is needed for the water to completely settle to the bottom of the tank. This creates the opportunity for contaminated fuel to go undetected. Also, the uncontaminated fuel in the lines and fittings must first be drained to detect the water-contaminated fuel. On some aircraft, more than a quart of fuel must be drained before any water appears. Most tiedown areas where preflights checks are performed belong to flight schools or fixed-base operators, most of whom do not encourage pilots to drain a quart of fuel on the asphalt because aircraft fuel tends to dissolve this particular surface. The pilot then, although responsible, is presented with situations in which water detection is difficult.

While the Board believes that pilots must conduct an adequate preflight check, we are concerned that this is not a total solution to the problem of fuel contamination. In addition to the current pilot responsibility, the Board believes that other measures should be taken to insure against contamination. For example, fuel dispensing systems could be required to be equipped with filter/separator units which respond to the presence of free water by shutting down.

The Board is aware that 14 CFR 139 prescribes rules governing the certification of land airports serving air carriers that hold certificates of public convenience and necessity issued by the Civil Aeronautics Board. Part 139.51 states that "... the applicant for an airport certificate must show that it (or its tenant), as the fueling agent, has a sufficient number of trained personnel and procedures for safely storing, dispensing, and otherwise handling fuel, lubricants, and oxygen on the airport (other than articles and materials that are, or are intended to be, aircraft cargo). . . ." This is the only rule that addresses the subject of storing and dispensing aviation fuel, and in addition, applies solely to air carrier airports. In the Board's opinion, 14 CFR 139 is inadequate even for those airports it covers because it does not address fuel contamination. Our accident statistics do not indicate that fuel contamination has been a problem to air carrier aircraft. However, informal communication with the FAA indicates that control of contamination is considered during airport certification via a rather broad interpretation of 14 CFR 139.51. The Board believes that the problem of fuel contamination should be specifically addressed for both air carrier and general aviation airports. In our judgment, fuel contamination should be specifically addressed for all segments of aviation rather than only that segment in which there is an apparent current problem. It has been generally accepted that standards for air carrier operations must be as stringent as they are for general aviation. We believe that the regulations should reflect this consistency.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Expand 14 CFR 139 to include minimum specifications and design criteria for the installation, maintenance, and inspection of aviation fuel storage and dispensing systems at airports certificated under 14 CFR 139. (Class II, Priority Action) (A-81-9)
>
> Take necessary action to establish minimum specifications and design criteria for aviation fuel storage and dispensing systems at public-use airports not certified under 14 CFR 139. In addition to the equipment itself, such criteria should address their installation, operation, maintenance, and inspection. (Class II, Priority Action) (A-81-10)

When specifications and criteria are established for aviation fuel storage and dispensing systems at public-use airports are not certified under 14 CFR 139, establish and implement procedures to verify compliance. (Class II, Priority Action) (A-81-11)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 11, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-81-12 and A-81-13 issued by the Board on February 10, 1981. These recommendations resulted from the Board's participation in the investigation of the Saudi Arabian Airlines Lockheed L-1011 accident at Riyadh, Saudi Arabia, on August 19, 1980.

A-81-12. Reevaluate the "Class-D" certification of the L-1011 C-3 cargo compartment with a view toward either changing the classification to "C," requiring detection and extinguishing equipment, or changing the compartment liner material to insure containment of a fire of the types likely in the compartment while in-flight.

FAA Comment. The L-1011 is not unique in having a large Class D type cargo compartment that has been demonstrated to be in compliance with the requirements of FAR 25.857(d). For this reason, the Federal Aviation Administration (FAA) does not believe specific action pertaining to the L-1011 as a special case is appropriate. Neither do we find that the limited tests cited by the Board are sufficient in themselves to justify the recommended action. In the research program discussed under Recommendation A-81-13, detection, extinguishment, and flammability of cargo compartment liners will be evaluated. Since the intent of this recommendation is embodied in the FAA research discussed under Recommendation A-81-13, we intend to take no further action on Safety Recommendation A-81-12.

A-81-13. Review the certification of all baggage/cargo compartments (over 500 cu. ft.) in the "D" classification to insure that the intent of 14 CFR 25.857(d) is met.

FAA Comment. The FAA concurs in principle with this recommendation. The severity and progression of the Saudi Arabian fire caused the FAA to immediately question the efficacy of the Class D fire containment

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concept. Immediately after the accident, the FAA began formulating a research program, to be accomplished at the Technical Center, to conduct a comprehensive reevaluation of the concept and regulatory standards for Class D cargo compartments. Prior to issuance of the Board's recommendation, the FAA met informally with the NTSB staff to discuss the preliminary results of the accident investigation. At that meeting, the Board staff members were advised of our program. On January 15, 1981, the Office of Aviation Standards formally requested the establishment of a research program. A copy of that request is enclosed. We believe the program we have initiated exceeds the intent of the NTSB's recommendation, and we will keep the Board informed of significant progress in this area.

Sincerely,

J. Lynn Helms
Administrator

Enclosure

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 10, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-12 through 13

The National Transportation Safety Board sent a U. S. Accredited Representative and accompanying advisors to participate in the investigation of the Saudi Arabian Airlines Lockheed L-1011 accident at Riyadh, Saudi Arabia, on August 19, 1980. The accident involved an in-flight fire in the aft area of the aircraft. Even though the aircraft was landed successfully, the fire spread and all 301 occupants died as a result. The investigation, conducted in accordance with the provisions of International Civil Aviation Organization Annex 13, is continuing and a report of the investigation will be issued by the Kingdom of Saudi Arabia upon completion. As part of U.S. assistance in the investigation, tests and research were conducted at the Lockheed California Company and at the Federal Aviation Administration (FAA) Technical Center, Atlantic City, New Jersey.

The fire ignition source and exact area in which the in-flight fire originated have not yet been determined. The aft baggage compartment (C-3), among others, where bulk baggage is carried beneath the aft cabin floor, is being investigated as a possible origination area. Among the tests conducted to evaluate certain hypotheses regarding fire propagation were fire penetration tests of the C-3 compartment lining materials. One test showed that a 5-inch diameter, 12-inch-high propane burner flame (1,800° F) placed beneath the C-3 compartment ceiling penetrated the ceiling liner in less than 1 minute and then penetrated the cabin floor and carpet material in less than 2 minutes. A second test using the same burner showed that a 3- to 4-foot-high flame (1,160° F, fuel rich) penetrated the ceiling liner in 25 seconds, and then the cabin floor and carpet material in 4.5 minutes.

The C-3 compartment of the L-1011 is certificated as "Class D" under the provisions of 14 CFR 25.857(d). That rule states, A Class D cargo or baggage compartment is one in which--

(1) A fire occurring in it will be completely confined without endangering the safety of the airplane or the occupants;

(2) There are means to exclude hazardous quantities of smoke, flames, or other noxious gases from any compartment occupied by the crew or passengers;

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(3) Ventilation and drafts are controlled within each compartment so that any fire likely to occur in the compartment will not progress beyond safe limits;

*****

(5) Consideration is given to the effect of heat within the compartment on adjacent critical parts of the airplane. For compartments of 500 cu. ft. or less, an airflow of 1,500 cu. ft. per hour is acceptable.

The Safety Board notes that its predecessor, Civil Air Regulation 4B.383, "Cargo Compartment Classification," contained the following regarding Class D compartments: "Note: For compartments having a volume not in excess of 500 cu.ft. an airflow of not more than 1,500 cu.ft. per hour is acceptable. For larger compartments lesser airflow may be applicable." This guideline at least suggested more conservative criteria should be followed for larger compartments while the existing rule does not address the airflow allowance in compartments larger than 500 cu.ft.

The volume of the C-3 compartment of the L-1011 is 700 cu. ft. Safety Board investigators have been advised by FAA that the L-1011 C-3 compartment was approved as "Class D" by "extrapolations" from the 500 cu. ft. volume and 1,500 cu. ft. per hour airflow guidelines in 14 CFR 25.857(d)(5). However, the theoretical concept of a Class D compartment is that a fire within the compartment would be extinguished by oxygen depletion, preventing its propagation. This concept apparently has been successfully applied in narrow-bodied aircraft with limited volume compartments. However, the Safety Board is concerned that it may not be a valid concept for larger volume compartments, such as the L-1011 C-3 compartment, because much greater volumes of oxygen are available to support combustion prior to depletion and "snuffing." The additional air supply can readily support a fire for sufficient time to allow penetration of the compartment lining, thereby providing access to an unlimited oxygen supply to support propagation of the fire. In fact, preliminary tests conducted at the FAA Technical Center, using a 770 cu.ft. simulated Class D compartment, illustrated that a fire of sufficient intensity to penetrate the L-1011 C-3's ceiling liner in less than 1 minute burned for more than 10 minutes after the compartment airflow was shut off.

The Safety Board is aware that the type of flames used in the tests at Lockheed and at the FAA Technical Center do not duplicate the type of flame (bunsen burner) used to certify flammability characteristics of cargo and baggage compartment interior materials (14 CFR 25.855). However, the Safety Board believes that a small fire in a piece of baggage could generate localized intense heat similar to that from the propane burner used in the recent tests and that the fire could penetrate the ceiling before the oxygen supply is depleted.

The penetration of the L-1011 C-3 compartment ceiling carries extremely hazardous consequences because numerous major aircraft components are routed between the ceiling of the compartment and the floor of the cabin. Among these items are the No. 2 engine throttle cables, the No. 2 fuel line, and flight control cables. Fire reaching these components could easily endanger the entire aircraft, and therefore, the design does not comply with the intent of 14 CFR 25.857(d)(5). Moreover, once such a fire reaches the cabin, the cabin furnishings will become involved, and the fire will be difficult to extinguish.

The Safety Board is aware of several instances of fire in checked baggage from ignition of matches and other items. In most of these instances, fires ignited while the aircraft were on the ground and the aircraft were not damaged. However, the possibility of such a fire while in-flight and the questionable capability of the L-1011 C-3 compartment to contain a fire by "snuffing" it to keep it from spreading suggest that the "Class D" certification of the C-3 compartment should be reevaluated.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Reevaluate the "Class-D" certification of the L-1011 C-3 cargo compartment with a view toward either changing the classification to "C," requiring detection and extinguishing equipment, or changing the compartment liner material to insure containment of a fire of the types likely in the compartment while in-flight. (Class I, Urgent Action) (A-81-12)
>
> Review the certification of all baggage/cargo compartments (over 500 cu. ft.) in the "D" classification to insure that the intent of 14 CFR 25.857(d) is met. (Class II, Priority Action) (A-81-13)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN and BURSLEY, Members, concurred in these recommendations.

James B. King

By: James B. King
Chairman

U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

May 20, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-81-14 issued by the Board on February 24, 1981. This recommendation resulted from the Board's investigation of the crash of United Air Lines Flight 173, a DC-8-61 aircraft, near Portland, Oregon, on December 28, 1978. The aircraft crashed as a result of fuel exhaustion after holding in the vicinity of the airport for approximately one hour while the flightcrew attempted to resolve landing gear problems.

<u>A-81-14</u>. Amend 14 CFR 121 and 14 CFR 135 to require that all air carrier operators include in their flight operations manuals minimum operational fuel requirements for their aircraft, including fuel quantities below which a landing should not be delayed. In determining minimum fuel quantities, allowances should be made for fuel quantity measuring system tolerances and for the possibility of a missed approach.

<u>FAA Comment</u>. The Federal Aviation Administration (FAA) has reviewed pertinent rules and air carrier operations bulletins and determined that sufficient guidance is presently available on the subject of fuel planning requirements and pilot-in-command (PIC) responsibilities. Therefore, we do not concur in the need to amend 14 CFR 121 or 14 CFR 135.

The scope of the Federal Aviation Regulations (FAR) on fuel planning provides adequate guidance for the PIC and the dispatcher. FAR 121.647 provides the foundation for assuring an adequate fuel supply for air carriers complying with Part 121 requirements. This FAR indicates that the person computing the required fuel shall consider wind and other weather conditions, anticipated traffic delays, an instrument approach and possible missed approach at destination, plus any other condition that might delay the landing. FAR 121.639 applies to the domestic operations cited. This section indicates that no person shall take off in an airplane unless it has enough fuel to fly to the airport to which it is dispatched,

then proceed to the most distant alternate, if required, and finally to fly for 45 minutes at normal cruising fuel consumption. Additional guidance on fuel planning requirements is found in FAR 91.5 and 91.23. FAR 135.61 also references Part 91 for operators complying with Part 135 rules. This guidance indicates that each PIC shall, before beginning a flight, familiarize himself/herself with all available information concerning that flight, including fuel requirements.

The specific responsibilities of the PIC are also adequately defined. Federal Aviation Regulations 91.3 and 121.555 state that the PIC has definite responsibilities prior to takeoff and that the PIC is directly responsible for a safe operation while in flight. Preflight planning must include provisions for an adequate fuel supply. In-flight operations must include monitoring the fuel supply. If a determination is made in flight that an unsafe condition exists, such as a low fuel state, the PIC and/or dispatcher are charged with the responsibility to declare an emergency, if required (FAR 121.557). In no case should a PIC continue a flight toward any airport if he/she determines that the flight cannot be completed safely (FAR 121.627).

Additional information nas been disseminated to our field inspectors through air carrier operations bulletins. Bulletin 8-79-2 specifically discusses the United Air Lines accident and places emphasis on correctly reading the fuel gauges and training the crews to correctly interpret the fuel gauges. Air Carrier Operations Bulletin 8-79-4 addresses flight planning to an alternate airport. This bulletin is directly related to the Pan American incident discussed in the NTSB safety recommendation. Some companies were planning direct routes when in actual practice the routing could result in a substantial increase in the distance. The resultant increase in required fuel was not accounted for in the flight planning process. The main thrust of this bulletin was to charge the principal operations inspectors to evaluate their carriers to assure reasonable profiles were being used for fuel planning purposes. This type of information dissemination provides the principal operations inspectors with data against which to measure the assigned carrier's operation and provide the impetus for change when found necessary.

The implications of this discussion are that the PIC's must perform certain duties. The preflight preparation that involves fuel planning must receive the appropriate attention by the PIC and, where applicable, the dispatcher. The guidelines contained in the current rules provide ample safety margins for the fuel planning process, and as the PIC participates in this process, he/she will have the necessary knowledge of the various categories of required fuel. This planning process provides the PIC with the necessary knowledge of the fuel quantity below which a landing should not be delayed.

The pilot's operational decisions must be based on this knowledge. If a problem should develop during flight, the PIC is vested with the authority to declare an emergency and take the necessary measures to safely complete

the flight. Therefore, the rules that affect the fuel planning and use process are considered adequate and amendment is not considered necessary. Accordingly, the FAA considers action completed on Safety Recommendation A-81-14.

Sincerely,

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 24, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-14

On December 28, 1978, United Air Lines Flight 173, a DC-8-61 aircraft, crashed as a result of fuel exhaustion near the Portland International Airport, Portland, Oregon, after holding in the vicinity of the airport for approximately 1 hour while the flightcrew attempted to resolve landing gear problems. Of the 181 passengers and 8 crewmembers aboard, 8 passengers and 2 crewmembers were killed, and 21 passengers and 2 crewmembers were injured seriously.

On October 20, 1979, a Pan American Airways Boeing 747 declared an inflight emergency because of a low fuel state. The investigation revealed an error in the aircraft's fuel quantity gages which indicated more fuel than the fuel tanks actually contained. Although the error was within the manufacturer's allowable tolerances, it contributed to the crew's failure to declare an emergency fuel situation earlier in the flight.

The Safety Board is concerned that the pilot-in-command of the DC-8-61 aircraft did not have guidance information for a minimum allowable amount of fuel with which to begin the approach/landing. The Safety Board believes that minimum fuel quantities below which landing should not be delayed should be specified for all aircraft that are operated under 14 CFR 121 and 14 CFR 135. Moreover, the Board believes that allowances for fuel quantity measuring system tolerances should be considered in making a minimum approach/landing fuel determination.

The Safety Board has learned informally that United Air Lines, recognizing a need for the foregoing guidance, has worked with the Boeing Company and McDonnell Douglas Corporation to incorporate into its aircraft flight manuals fuel limitations and specifications, including the minimum fuel quantity required for an approach and go-around.

The National Transportation Safety Board fully supports this United Air Lines effort in the interest of aviation safety. The Safety Board believes that the operational deficiencies associated with a lack of guidance on fuel minimums and fuel quantity measurement system tolerances can be eliminated by an industrywide implementation of procedures similar to the United Air Lines program.

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Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend 14 CFR 121 and 14 CFR 135 to require that all air carrier operators include in their flight operations manuals minimum operational fuel requirements for their aircraft, including fuel quantities below which a landing should not be delayed. In determining minimum fuel quantities, allowances should be made for fuel quantity measuring system tolerances and for the possiblity of a missed approach. (Class II, Priority Action) (A-81-14)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

James B. King

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 26, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to Safety Recommendations A-81-15 and A-81-16 issued by the Board on February 24, 1981. These safety recommendations resulted from the Board's investigation of the crash of a Cessna Model 172K (XP) during takeoff at the Eagle Creek Airport near Indianapolis, Indiana, on February 26, 1980.

The Board stated, "Investigation revealed that the pilot's seat was not locked and had slid rearward on the seat rails during liftoff. . . . If the pilot had attempted to position and lock her seat in the full forward position in the aircraft, the left front corner of the seat would have contacted and wedged against the door jamb. This interference, which is typical in this aircraft model, can prevent the seat locking pins from reaching the forwardmost locking holes. . . ."

A-81-15. Issue an Airworthiness Directive for Cessna aircraft in which interference between seats in the full forward position and door jambs currently exists requiring that the seat rail stops be positioned to permit proper seat locking in all seat positions.

FAA Comment. The Federal Aviation Administration's (FAA) analysis of the accident data on the Eagle Creek Airport crash of the Cessna 172K (XP) on February 26, 1980, has raised questions concerning the probable sequence of events that caused the actual crash. This has placed in question the part that seat slipping may have had in causing the crash. In order to complete our analysis of whether some Cessna seats may not lock in place properly because of interference with the door jamb, we are analyzing our service difficulty reports, inspections of Cessna production aircraft, and some additional data supplied by the Board on other accidents where slippage of the pilot's seat was determined to be a causal element. We expect to have our analysis completed by August 1, 1981, and will provide a more complete response at that time.

A-81-16. Require the Cessna Aircraft Company to include an adjustment and locking check of front seats, belts, and shoulder harnesses on the "before takeoff" checklists applicable to all Cessna aircraft. This item should be included on new checklists as soon as possible.

FAA Comment. In view of our comments on Safety Recommendation A-81-15, we believe it prudent to withhold any decision or action on this safety recommendation until we have completed our analysis on the issues surrounding any seat problem that may exist.

Sincerely,

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 24, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-15 and -16

On February 26, 1980, a Cessna Model 172K (XP) crashed during normal takeoff from the Eagle Creek airport near Indianapolis, Indiana. The pilot, a commercial flight instructor and the only occupant of the aircraft, was killed. According to witnesses, the aircraft pitched up to a steep nose high attitude, about 60° or 70°, and the sound of engine power reduced abruptly from takeoff power to idle. The aircraft then pitched down and rotated about 160° to the left before crashing on the edge of the asphalt runway.

Investigation revealed that the pilot's seat was not locked and had slid rearward on the seat rails during liftoff. The pilot weighed 105 pounds and was 5 feet 3 inches tall. Acquaintances stated that she flew all types of aircraft with her seat in a full-forward position and required an extra seat cushion to enable her to see over the glareshield of the instrument panel. Because of her relatively short stature, she could not reach the throttle or rudder pedals or fully manipulate the control wheel of the above aircraft with her seat in its rearmost position. Consequently, once the seat slid aft, she was not able to maintain control or regain control when the pitch angle increased abruptly. The pitch up of the aircraft to a steep nose high attitude and the reduction in power would be the expected consequences of the pilot's holding onto the control yoke and the throttle as her seat slid aft.

If the pilot had attempted to position and lock her seat in the full forward position in the aircraft, the left front corner of the seat would have contacted and wedged against the door jamb. This interference, which is typical in this aircraft model, can prevent the seat locking pins from reaching the forwardmost locking holes. More importantly, however, the wedging of the seat can lead the pilot to believe that the seat is locked when, in fact, the locking pins are actually positioned between locking holes. Any subsequent forces on the seat, such as those occurring during takeoff, liftoff, or landing, can cause the seat to release abruptly and slide aft.

The pilot's operating handbook for the Cessna model 172K (XP) aircraft includes the pilot's check of the adjustment and locking of seats, belts, and shoulder harnesses on the "before starting engine" checklist. However, because some pilots may find it necessary to readjust the seat before takeoff, the Safety Board believes that a check to ensure that front seats, belts, and harnesses are adjusted and locked also should be included on the "before takeoff" checklist.

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Between 1970 and 1979, various Cessna aircraft were involved in 20 accidents in which slippage of the pilot's seat during takeoff or landing was determined to have been a causal element.

In view of the above, the Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive for Cessna aircraft in which interference between seats in the full forward position and door jambs currently exists requiring that the seat rail stops be positioned to permit proper seat locking in all seat positions. (Class II, Priority Action) (A-81-15)
>
> Require the Cessna Aircraft Company to include an adjustment and locking check of front seats, belts, and shoulder harnesses on the "before takeoff" checklists applicable to all Cessna aircraft. This item should be included on new checklists as soon as possible. (Class II, Priority Action) (A-81-16)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

James B. King

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 11, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-81-18 issued by the Board on February 24, 1981. This recommendation resulted from the Board's investigation of the crash of a British Redcoat Air Cargo, Ltd., Bristol Britannia, 253F, near Billerica, Massachusetts, on February 16, 1980.

A-81-18. Promulgate regulations to require that unit pieces in bulk load air cargoes are labeled as to actual weight.

FAA Comment. The NTSB investigation of this accident revealed that there was an apparent laxity in determining the weight of individual pieces in bulk cargo shipments. As a result of the investigation, the Safety Board, even though it was acknowledged that weight and balance was not a factor in the crash, expressed concern regarding inaccuracy resulting from items being marked with incorrect weight. The Safety Board stated that Federal Aviation Regulations (FAR) Part 121, Section 121.665 holds each certificate holder responsible for the preparation and accuracy of a load manifest before each takeoff and that Section 121.693(a) requires the load manifest to contain the total weight of the cargo aboard. However, a major concern expressed was the lack of a FAR that requires the labeling of individual items according to weight. There are no regulations to require a freight forwarder to have scales available whenever the weight of a shipment is unknown or questionable.

The Federal Aviation Administration (FAA) recognizes that there is no regulation, as such, for labeling individual pieces of cargo shipped aboard U.S. carriers. However, there are regulatory factors that control the total weight and balance programs. This control is through operations specifications that require each carrier to have an FAA-approved method for accurately determining the weight and balance of each aircraft. In this approved program, the procedure must be spelled out in the carrier's manual, which, through the operations

specifications, then becomes regulatory. The manual must provide for weighing when specific weights are not displayed and it must also contain procedures for spot checking the accuracy of the already labeled items. Advisory Circular 120-27A, Aircraft Weight and Balance Control, provides the carrier with methods and procedures for developing an approved weight and balance control system.

In addition to the approved weight and balance program, Air Carrier Operations Bulletin No. 8-76-3, Declaration of Erroneous Cargo Weights, states that principal inspectors are to review their assigned operator's manual to ensure that adequate procedures are established for the spot checking of declared cargo weights furnished by air freight forwarders in order to assure the use of accurate load manifests and weight and balance computations.

In view of these established programs which, in effect, have regulatory control over the weight and balance procedures approved for U.S. certificate holders, the FAA does not believe that additional action is needed, and action on Safety Recommendation A-81-18 is considered completed.

Sincerely,

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 24, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-18

About 1416 e.s.t. on February 16, 1980, a British Redcoat Air Cargo, Ltd., Bristol Britannia, 253F, crashed in a wooded area near Billerica, Massachusetts, about 7 minutes after takeoff from Logan International Airport in Boston. Of the six crewmembers and two passengers aboard, only the flight engineer survived.

Although weight and balance and center of gravity problems did not contribute to the cause of this accident, the National Transportation Safety Board's investigation revealed apparent lax practices in determining the weight of individual pieces in bulk cargo shipments. These practices appear to involve manufacturer/shippers and freight forwarders, as well as air carriers and flightcrews. The Safety Board believes that this laxness is perpetuated by the absence of regulatory guidelines.

During its investigation, the Safety Board learned that the aircraft loadmaster was told that the 168 pieces had a total weight of 35,574 lbs. The investigation revealed that the actual weight of the cargo was 32,860 lbs—a 2,714-lb error. According to the testimony of the freight forwarder's loaders, the loadmaster estimated the weight of each unit as he selected it for loading. He made selections from cargo located on the ramp while he stood on the aircraft. These random selections involved individual cartons, or skids containing a number of cartons, which were not marked with individual weights. Although a scale was readily available, it was not used to determine the weight of any cartons or skids. No attempt was made by the freight forwarder to cross-check the declared weight by weighing representative pieces. The loadmaster used the declared total weight to compute the weight and balance in accordance with company procedures on the form provided. As far as determining the accuracy of the computed c.g. is concerned, the loadmaster is reported to have checked the nose wheel strut extension for movement several times. This procedure, although better than nothing, cannot be condoned by the Safety Board.

2951-C

During the investigation, the loading of another Britannia was observed at the Hopkins International Airport, Cleveland, Ohio. The load consisted of shipments from several sources; for most of the shipments only the total weight was provided, with no weights marked on, or attached to, individual pieces or skids of varying sizes and weights. Because the shipments were about the same weight and volume ,the shipments were treated as equal entities and balanced one against the other. However, a part of one shipment consisted of a large, unmarked crate which was not identified on the shipper's waybill. Because of its size, it had to be separated from the rest of the shipment. A discussion ensued between the aircraft loadmaster and the freight forwarder supervisor regarding the placement of the large, unmarked crate in the aircraft. When the Safety Board investigator asked that the crate be weighed, the freight forwarder supervisor stated that he had no scale. When a scale was eventually located, the crate was found to weigh 2,195 lbs. After recalculation, the crate was placed where the ground loader had originally said it should go. The Safety Board is aware of the value of experience; however, it is also aware of what can happen when inexperienced personnel operate according to their own inclinations in the absence of sound, proven procedures.

Although, as noted earlier, weight and balance and center of gravity problems did not contribute to the cause of the crash of the Redcoat Air Cargo, Ltd., Bristol *Britannia*, the use of trial and error methods in loading creates a great potential for error in bulk loaded aircraft. Especially vulnerable are those operated by supplemental air carriers and commercial operators who do not have their own ground personnel and facilities and who, therefore, have to rely on the freight forwarder or shipper for vital information.

Regulation 14 CFR 121.665 holds each certificate holder responsible for the preparation and accuracy of a load manifest form before each takeoff. Regulation 14 CFR 121.693(a) requires that the load manifest contain, among other items, the total weight of the cargo aboard. There are no Federal Aviation Regulations that require the labeling of individual items according to weight, and there are no regulations to require a freight forwarder to even have a scale available for use whenever the weight of a shipment is unknown or questionable. In fact, there appears to be no regulation that fixes the responsibility of anyone but the certificate holder, and in his case, it is directed to the preparation of a load manifest. In addition, air freight forwarders no longer are required to be certificated by the Civil Aeronautics Board. This requirement was removed when the airline industry was deregulated.

Therefore, the Safety Board is concerned that when a shipment's declared weight is inaccurate, whatever the reason, or when individual items are not marked with their weight, serious weight and balance problems could result and that there are no means, short of refusing the shipment, to compel a shipper to furnish this information or to verify its accuracy.

The Safety Board is cognizant of the fact that the FAA does not have jurisdiction over the movement of freight by modes other than aviation; however, the Board believes that the FAA must take a more active role in regulating the movement of freight by air. In that regard, the Safety Board has made the following recommendation to the Department of Transportation:

> Determine which agencies have jurisdiction over shippers and freight forwarders, and coordinate joint efforts with those agencies to promulgate guidelines that specify the responsibilities of shippers, freight forwarders, and air carrier certificate holders in determining unit weights in bulk air cargo shipments so as to facilitate compliance with current manifest requirements by air carrier certificate holders. (Class II, Priority Action) (A-81-17)

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Promulgate regulations to require that unit pieces in bulk load air cargoes are labeled as to actual weight. (Class II, Priority Action) (A-81-18)

KING, Chairman, DRIVER, Vice Chairman, and McADAMS and BURSLEY, Members, concurred in this recommendation. GOLDMAN, Member, did not participate.

James B King

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 26, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-81-19 and A-81-20 issued by the Board on February 27, 1981. These recommendations resulted from the Board's investigation of several accidents in which the ground proximity warning system (GPWS) was a factor.

A-81-19. Instruct all air carriers to include in their flightcrew procedures instructions which require an immediate response to the ground proximity system's terrain closure "pull-up" warning when proximity to the terrain cannot be verified instantly by visual observation. The required response to this warning should be that the maximum available thrust be applied and that the aircraft be rotated to achieve the best angle climb without delay.

FAA Comment. The Federal Aviation Administration (FAA) concurs in this recommendation. FAR 121.360(c)(1)(ii) requires that each operator's airplane flight manual contain proper flightcrew action with respect to the GPWS equipment. The Safety Board states that some operators' existing procedures do not adequately comply with this regulation. We concur in this analysis. We believe, however, that the recommended procedural response regarding power application and aircraft rotation could be misinterpreted. The sequencing and execution of this response depends on the existing flight parameters. Therefore, the FAA intends to develop and publish an air carrier operations bulletin which will reemphasize the provisions and the intent of FAR 121.360(c)(1)(ii) and which will include unambiguous procedural guidance. We will inform the Board when this action is accomplished.

A-81-20. Instruct air carriers to include in their initial and recurrent simulator training curricula situations involving radar controlled as well as noncontrolled flight wherein ground proximity warning system alarms are given and flightcrew response to those warnings system alarms are evaluated.

<u>FAA Comment</u>. The FAA concurs, in part, with this recommendation, but we do not agree with the suggested implementation. We agree that during initial and recurrent simulator training, when a GPWS alarm occurs, regardless of its origin, the flightcrew's response should be evaluated and debriefed for procedural adequacy. This training function will be emphasized in the text of the previously referenced air carrier operations bulletin. We do not concur with the recommendation that initial and recurrent simulator training curricula should include contrived situations wherein unsafe flight parameters are intentionally entered in order to trigger GPWS alarms. Such curricula additions constitute negative training which is contrary to the goal of realistic simulation and which perpetuates the "delayed response syndrome" that the Safety Board discusses in its narrative. Therefore, we do not advocate altering existing air carrier simulator curricula in accordance with the Safety Board's recommendation, and the FAA intends to take no further action on this portion of Safety Recommendation A-81-20

Sincerely,

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 27, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-19 and -20

On May 8, 1978, near Pensacola, Florida, a Boeing 727 crashed into the water after receiving a terrain closure "pull-up" ground proximity warning system alert. The company's procedures stated that, upon receipt of the system's visual and aural terrain closure warning, "positive action to alter the flightpath to stop the warning should be initiated immediately." Despite these guidelines, the pilot continued his descent while the ground proximity warning system's terrain closure warning continued unabated for 9 seconds until the flight engineer--on the mistaken belief that he had been ordered to do so--turned the system off and silenced the warning. The investigation showed that, except for a slight decrease in the rate of descent which occurred 7 seconds after the warning began, the descending flightpath remained virtually unchanged throughout the entire 9-second interval that the warning was in progress. The Safety Board believes that had the pilot complied in a timely manner with his company's flightcrew response procedures, the crash would have been avoided.

On April 25, 1980, a Boeing 727, operated by a United Kingdom charter air carrier, crashed into a mountain ridge on the island of Tenerife, Grand Canary Islands, Spain, 5 seconds after the flightcrew received a "pull-up" warning from the ground proximity warning system. After the warning began, the pilot applied the maximum available thrust and attempted to stop the aircraft's descent by reversing the direction of the turn the aircraft was in when the alarm began; however, the pilot failed to rotate his aircraft and initiate a climb. Performance data showed that the ridge could have been cleared if a best angle climb had been initiated when the warning began.

In both accidents, the evidence indicated that the flightcrews were not in visual contact with the terrain.

The Safety Board is concerned that the two accidents may be indicative of a tendency of pilots to question the reliability of the ground proximity warning system and, thus, delay their response to the terrain closure warning, and that some existing flightcrew response procedures do not emphasize either the necessity for an immediate response to the warning or the type of response that will insure that timely and adequate measures have been taken to forestall ground impact. Our concern over the latter area resulted from our examination of the published procedures of 12 air carriers. While 8 of the 12 required their flightcrews to execute an immediate pullup on receipt of the warning, only 5 of these 8 specified the manner in which the maneuver was to

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be made with regard to aircraft rotation and thrust application. The published procedures of three of the remaining four air carriers require their flightcrews to "immediately" alter the aircraft's flightpath to stop the warning. Finally, one air carrier's procedure states that when the "pull-up" warning occurs, an immediate pullup will be made unless it is readily apparent that the warning is due to a malfunction or it is clear that a hazardous condition does not exist.

Recently, the Boeing Commercial Aircraft Company's flightcrew training department published "The Delayed Response Syndrome," which discussed the pilot's response to the ground proximity warning system. The paper noted that, although human factors research has shown that, depending on the workload, the normal response time to a critical warning is 1 to 4 seconds (Boeing Document D6-44200, "Human Factors Guidelines for Caution and Warning Systems), data from flight and voice recorders have shown that the response time to a terrain closure "pull-up" warning varied from a minimum of 5 seconds to 15 seconds or longer.

Boeing believes that this delay is attributable to two factors. First, during the early period of ground proximity warning system operations, flightcrews were subjected to frequent nuisance and unwanted terrain closure warnings that reached a level of 1 in every 10 approaches. Consequently, flightcrews began to verify the warnings by flight instrument displays (or visually if in visual meteorological conditions) before applying corrective action.

The situation was compounded by the incompatibility of the early ground proximity warning systems with certain training maneuvers, such as back course, nonprecision, below-glide-slope approaches to displaced thresholds, and demonstrated approaches that intentionally exceeded the ground proximity systems envelopes. The resultant warnings, which occurred during these maneuvers, further compromised the system's credibility.

Secondly, most of the terrain warnings occurred while the aircraft was operating under radar control. Understandably, some time would be required to recover from the mental impact of such a warning under these conditions, especially if doubts concerning the system's credibility still lingered. Interestingly, in the accidents cited one aircraft was operating under radar control and the other had been cleared by a controller to enter a holding pattern and was trying to do so. The Safety Board believes that the accidents tend to validate the rationale concerning the existence of a "delayed response syndrome" within the pilot community to this type of warning, and, therefore, corrective action should be taken to counteract and eliminate any resistance to a ground proximity system terrain closure warning.

The Safety Board believes that conditioned responses are not generally acceptable in the cockpit. In most instances, some analysis of the situation is desired or required, but the criticality of ground impact demands an instant response to a warning of its imminence, rather than an analysis of the validity of the warning and the reliability of the system supplying the warning. The desired response to this type of warning should be set forth precisely, and it should require the immediate application of the maximum available thrust and rotation of the aircraft to achieve best climb performance. The Safety Board believes these procedures are now necessary, especially since design improvements of the ground proximity warning system have virtually eliminated nuisance warnings.

Therefore, the Safety Board recommends that the Federal Aviation Administration:

> Instruct all air carriers to include in their flightcrew procedures instructions which require an immediate response to the ground proximity system's terrain closure "pull-up" warning when proximity to the terrain cannot be verified instantly by visual observation. The required response to this warning should be that the maximum available thrust be applied and that the aircraft be rotated to achieve the best angle climb without delay. (Class II, Priority Action) (A-81-19)
>
> Instruct air carriers to include in their initial and recurrent simulator training curricula situations involving radar controlled as well as noncontrolled flight wherein ground proximity warning system alarms are given and flightcrew response to those warnings system alarms are evaluated. (Class II, Priority Action) (A-81-20)

KING, Chairman, DRIVER, Vice Chairman, and McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Thank you for your letter dated May 26, 1981, responding to National Transportation Safety Board Safety Recommendations A-81-21 and A-81-22 issued March 12, 1981. These recommendations stemmed from our investigation of an incident involving a Beech King Air which occurred en route between Dallas/Fort Worth and Higgins, Texas, on March 3, 1980. At an altitude of approximately 11,5[illegible] feet m.s.l. the aircraft was subjected to an explosive decompression when a forward cabin window failed. Examination revealed indications of a failure mode similar to other failures of cast acrylic cabin windows installed in King Air aircraft. We made the following two recommendations to the Federal Aviation Administration (FAA):

> Amend Airworthiness Directive 77-23-[illegible] to require more frequent inspections of cast acrylic windows and consider reducing the length of the crack or craze at which the windows must be replaced.

> Advise owners/operators of affected Beech aircraft of the hazards of operating their aircraft with crazed or cracked acrylic windows, and recommend that cast windows be replaced with stretched acrylic windows at the earliest opportunity.

The Safety Board is pleased to note that the FAA agrees with both recommendations and is taking action toward their fulfillment. They are classified in an "Open--Acceptable Action" status pending completion of the FAA's ongoing actions.

Sincerely yours,

James B. King

James B. King
Chairman

US Department of Transportation
Federal Aviation Administration

Office of the Administrator

800 Independence Ave. S.W.
Washington D.C. 20591

May 26, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-81-21 and A-81-22 issued by the Board on March 12, 1981. These recommendations resulted from the Board's investigation of an incident involving explosive decompression experienced by a Beech King Air, N30AA, between Dallas/Fort Worth and Higgins, Texas, on March 3, 1980.

A-81-21. Amend Airworthiness Directive 77-23-07 to require more frequent inspections of cast acrylic windows and consider reducing the length of the crack or craze at which the windows must be replaced.

FAA Comment. The Federal Aviation Administration (FAA) concurs in this recommendation, and will expedite issuance of an airworthiness directive (AD) to require more frequent inspections and replacement whenever any crack or stress craze is found. We will provide the Board with a copy of this AD when issued.

A-81-22. Advise owners/operators of affected Beech aircraft of the hazards of operating their aircraft with crazed or cracked cast acrylic windows, and recommend that cast windows be replaced with stretched acrylic windows at the earliest opportunity.

FAA Comment. The FAA also concurs in this recommendation. Supplementary information, which will accompany the previously mentioned AD, will address the hazards associated with cracked or crazed cast acrylic windows. The requirement for replacement of cast acrylic windows with stretched acrylic windows will be addressed in a follow-on AD, which will be issued when parts availability is sufficient to preclude grounding of much of the affected fleet.

FAA's Central Region is presently working with the manufacturer to establish mutually acceptable service instructions, after which we plan to issue an AD. The Board will be informed when these actions are accomplished.

Sincerely,

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

CORRECTED COPY

ISSUED: March 12, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-21 and -22

On March 3, 1980, a Beech King Air (65A90), N30AA, was being operated as an air taxi passenger flight and had departed the Dallas/Fort Worth Airport, Texas, at 1200 c.s.t. en route to Higgins, Texas. At 1230 c.s.t., the aircraft experienced an explosive decompression at 11,500 feet m.s.l. when the forward left-hand cabin window failed. The pilot reduced power, slowed the aircraft, and started an immediate descent to Love Field, Dallas, Texas. The aircraft was landed without further incident.

The National Transportation Safety Board's investigation of the incident and its review of pertinent Service Difficulty Reports indicate that corrective action is necessary to reduce the potential for similar occurrences.

Pieces of the failed cast acrylic window, P/N 50-420013-191, and a like window from the aircraft cabin, which showed evidence of a stress craze of less than 3/8-inch in length, were examined at the Beech Aircraft facility in Wichita, Kansas. The examination revealed indications of failure modes similar to those that occurred in other failures of cast acrylic cabin windows from King Air aircraft.

A survey of the FAA Maintenance Analysis Center records on the Beech King Air indicated that 70 cockpit and cabin window discrepancies have been reported over the last 6 years. Three of the discrepancies involved failure of cabin window P/N 50-420013-191 at altitude. In one case, the aircraft was at 20,000 feet and the window that failed had been inspected 20 flight-hours before.

According to AD 77-23-07 and the manufacturer's class-I mandatory compliance Service Instruction, No. 0711-110, Revision II, replacement of cockpit side windows, cabin windows, and baggage compartment windows is predicated upon the finding of a stress craze or crack 3/8 inch or longer. If a 3/8-inch or longer stress craze or crack is discovered during any inspection, the window is to be replaced with a new stretched acrylic window (P/N 50-430013-1053) before the next flight or the aircraft must be placarded and left unpressurized until a new window is installed. If a craze or crack less than 3/8 inch is discovered, the window must be reinspected each 100 flight-hours. Otherwise, the windows need only be inspected at 500-hour intervals. The fact that one cast acrylic window failed about 20 hours after an inspection indicates that the inspection intervals and criteria may not be adequate.

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The Safety Board was informed by the aircraft manufacturer, during a recent 12-month period, that 21 *cast acrylic windows* have failed, 9 of which were cabin windows. Additionally, a review of the manufacturer's data indicated that there were no stretched acrylic window, P/N 50-430013-1053, failures reported during that 12-month period.

In view of the potential catastrophic results of aircraft window failures at high altitude, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend Airworthiness Directive 77-23-07 to require more frequent inspections of cast acrylic windows and consider reducing the length of the crack or craze at which the windows must be replaced. (Class II, Priority Action) (A-81-21)
>
> Advise owners/operators of affected Beech aircraft of the hazards of operating their aircraft with crazed or cracked cast acrylic windows, and recommend that cast windows be replaced with stretched acrylic windows at the earliest opportunity. (Class II, Priority Action) (A-81-22)

KING, Chairman, DRIVER, Vice Chairman, and McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

James B. King

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

June 5, 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Thank you for your letter dated May 1, 1981, responding to National Transportation Safety Board Safety Recommendation A-81-23 issued March 3, 1981. This recommendation stemmed from our investigation of an Air Wisconsin, Inc., Swearingen SA-226 Metro which crashed near Valley, Nebraska, on June 12, 1980. We recommended that the Federal Aviation Administration (FAA) publish procedures in Air Traffic Control Handbook 7110.65B covering the handling of Center Weather Advisories (CWA's).

The Safety Board is pleased to learn that the FAA and National Weather Service representatives will meet to determine the future role of CWA's in aviation weather and, following the meeting, air traffic directives will be published for the handling of CWA's. Safety Recommendation A-81-23 is classified in an "Open--Acceptable Action" status.

We appreciate the FAA's offer to keep us informed of changes in the status of this recommendation.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 1, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-81-23 issued by the Board on March 3, 1981. This recommendation resulted from the Board's investigation of the crash of an Air Wisconsin, Inc., Swearingen SA-226 Metro, near Valley, Nebraska, on June 12, 1980.

A-81-23. Publish procedures in Air Traffic Control Handbook 7110.65B covering the handling of Center Weather Advisories.

FAA Comment. Prior to June 1981, the Federal Aviation Administration and National Weather Service representatives will meet to determine the "official" status and future role of Center Weather Advisories (CWA's) in aviation weather. Following that meeting, we plan to develop and publish procedures in appropriate air traffic directives for the handling of CWA's. We will keep the Board informed of significant progress in this area as our efforts continue.

Sincerely,

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 3, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-23

About 1546 c.d.t., on June 12, 1980, an Air Wisconsin, Inc., Swearingen SA-226 Metro operating as Flight 965 crashed near Valley, Nebraska. Flight 965 encountered an area of severe thunderstorms while at an altitude of less than 6,000 feet and experienced a simultaneous loss of power to both engines because of massive water ingestion. The aircraft crashed in a field and was destroyed. Of the 15 persons aboard the aircraft, 13 were killed and 2 were injured seriously.1/

During the investigation, an examination of Air Traffic Control (ATC) Handbook 7110.65B revealed that procedures for handling Center Weather Advisories (CWAs) are not contained in the Handbook. CWAs are prepared by meteorologists in the Air Route Traffic Control Centers (ARTCC) and are issued as an update to reflect changing conditions in current hourly Convective SIGMETS, 2/ as well as when meteorological conditions meet SIGMET 3/ criteria. CWAs are disseminated by the weather coordinator/flow controller in the ARTCC to the affected sectors and Federal Aviation Administration facilities.

Currently, procedures for handling Convective SIGMETS and SIGMETS are contained in paragraph 41 of ATC Handbook 7110.65B. However, because of the nature and importance of CWAs to the safety of all aircraft, the Safety Board believes that procedures for handling CWAs should also be included in the Handbook.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

1/ For more detailed information, read "Aircraft Accident Report—Air Wisconsin, Inc., Swearingen SA-226 Metro, N650S, Valley, Nebraska, June 12, 1980" (NTSB-AAR-80-15).
2/ A weather advisory issued by the National Severe Storms Forecast Center in Kansas City, Missouri, concerning convective weather significant to the safety of all aircraft.
3/ A weather advisory issued by the National Weather Service concerning weather significant to the safety of all aircraft. A SIGMET is issued for severe and extreme turbulence, severe icing, and widespread duststorms/sandstorms lowering visibilities to below 3 miles.

3009-B

Publish procedures in Air Traffic Control Handbook 7110.65B covering the handling of Center Weather Advisories. (Class II, Priority Action) (A-81-23)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

By: James B. King
Chairman

US Department
of Transportation

Federal Aviation
Administration

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

June 10, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to Safety Recommendations A-81-24 and A-81-25, issued March 12, 1981. This also addresses Safety Recommendation A-79-95 which the Board had previously classified in a "Closed--Acceptable Action" status on May 27, 1980. We are also responding to Safety Recommendation A-79-80 which the Board, in correspondence dated February 20, 1981, classified in an "Open--Unacceptable Action" status.

A-81-24. Require that pilot training programs for 14 CFR 135 certificate holders which operate light twin-engine aircraft include specific ground and flight training in: (1) the factors related to achieving and maintaining Vyse; (2) the capability of aircraft to maintain level flight at airspeeds below Vyse while in single-engine configuration; (3) the capability of company aircraft to accelerate to Vyse while in a single-engine configuration; and (4) rapid appraisal of those situations in which a controlled, straight-ahead emergency landing is the safest or only option available.

A-81-25. Require that aircraft flight manuals for light twin-engine aircraft used in 14 CFR 135 operations contain data related to those conditions in which the aircraft, in a single-engine configuration and at airspeeds between Vmc and Vyse, has the capability to maintain level flight.

FAA Comment. The Federal Aviation Administration (FAA) recognizes the limited engine-out performance capability of light twin-engine aircraft during takeoff. The development of the specific ground and flight training which you recommend would be dependent upon the availability of data you recommend for inclusion in aircraft flight manuals. Some manufacturers do not publish detailed performance data which could be used to develop operational guidance or flight demonstrations that would result in an effective airborne recovery in a high drag configuration and also guarantee obstacle clearance. However, a number of manufacturers that comply with GAMA Specification No. 1 (which is accepted by the FAA as complying with small airplane flight manual requirements) do provide single-engine climb

performance data such as that shown in the enclosed Figure 5-19 from the Cessna 404 airplane flight manual. This information should provide a basis on which to conduct preflight planning and decisionmaking relative to continuing flight or making an emergency landing in the event of engine failure. We have, in the past, and will continue to strongly urge compliance by small twin-engine airplane manufacturers with GAMA Specification No. 1. This specification should include the effect of landing gear, flaps, and windmilling propeller, as well as the necessary conditions, such as bank angle, for achieving this performance. As you are aware, the diverse spectrum of contributing factors, such as weight, temperature, altitude, and aircraft configuration makes the prospect of the development of such data for all aircraft in service impractical, and we cannot now justify requiring all manufacturers to develop such data. A regulatory review of 14 CFR 23, Airworthiness Standards: (Normal, Utility, and Acrobatic Category Airplanes) is being developed by the Associate Administrator for Aviation Standards. In this review priority consideration would be given to the requirement for specific takeoff performance data.

In the interim, in addition to the above actions, the Office of Associate Administrator for Aviation Standards is incorporating in appropriate FAA orders and handbooks additional emphasis on the importance of training for potential power failure on takeoff. We plan to revise information contained in Advisory Circular AC 135.3B. We will keep the Board informed of our actions and will provide copies of the revised documents when they are published.

A-79-95. Periodically disseminate to pilots, certificated flight instructors, and FAA inspectors and their designees, additional information on how to manage light twin-engine aircraft following an engine failure, using advisory circulars, safety seminars, or other means at its disposal.

FAA Comment. In a letter dated May 27, 1980, the Board acknowledged the FAA's action in response to this safety recommendation and placed it in a "Closed--Acceptable Action" status. The FAA's actions with regard to Safety Recommendation A-79-95 have been ongoing and we will continue our efforts under the FAA's safety charter as outlined in the Federal Aviation Act of 1958 as amended. You are also aware of the dissemination of the Accident Prevention Program publications FAA-P8740-19 and 25 (copies enclosed) regarding light twin-engine aircraft operation. Accordingly, we do not believe it is necessary to reopen this safety recommendation and the FAA considers action completed on Safety Recommendation A-79-95.

A-79-80. Require that pilots involved in 14 CFR 135 operations be thoroughly trained on the performance capabilities and handling qualities of aircraft when loaded to their maximum certificated gross weight or to the limits of their c.g. envelope, or both.

FAA Comment. As outlined in the FAA's letter of August 27, 1980, our analysis indicates that additional operating experience, as required in Section 135.244, is an effective and workable method to ensure satisfactory pilot performance when operating at or near aircraft limitations. We have

noted the Board's acknowledgement of the impractical aspects of flight training in an aircraft loaded to gross weight or at c.g. limits, and their belief that pilots should be thoroughly familiar with performance deficiencies that are experienced in training under conditions approaching these limits. We also note the Board's comments that ". . . training for a potential emergency . . ." in some light twin-engine airplanes ". . . such as an engine-out condition, may be more hazardous than the emergency itself . . . ." The FAA has insured that safe operating knowledge and practices are acquired through a combination of increased experience reflected in Section 135.244, and approved pilot training programs.

The experience required by Section 135.244 is obtained on commuter passenger-carrying operations, other than as pilot-in-command, which are frequently conducted at or near maximum certificated gross takeoff weight. The pilot's response to emergencies is contained in the certificate holder's approved pilot training program. The emergency procedures are based upon those contained in the aircraft flight manual. As previously stated the FAA not only approves the content of the operator's training programs, but also has placed special emphasis in this area. In addition, Change 6 to Chapter 3, Section 8, FAA Order 8320.12, incorporated instructions that deal specifically with weight and balance control for FAR 135 operators of aircraft certificated for nine or less passengers. These instructions contain additional requirements that must be met when approving a weight and balance control program for these operators. We believe that these changes, coupled with current requirements for larger operators, the revisions of AC 120-27A, and previous notices and GENOTS concerning Part 135 weight and balance, are fully responsive to Safety Recommendation A-79-80.

In summary, the FAA's actions relative to safety of Part 135 operations have been extensive. We believe the improved safety record during 1980 reflects the effectiveness of this effort. We intend to continue our aggressive actions in this area, which we believe are fully responsive to the Safety Recommendations addressed herein.

Sincerely,

J. Lynn Helms
Administrator

Enclosures

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 12, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-24 and -25

On July 21, 1980, Scenic Airlines Flight 306, a Cessna 404, N26835, crashed during takeoff from the Grand Canyon National Park Airport, Tusayan, Arizona. The left engine turbocharger failed after takeoff causing a substantial power loss. The aircraft was not able to climb or maintain altitude because the pilot failed to establish immediately a minimum drag configuration which further degraded the aircraft's performance significantly. The aircraft was 856 lbs below its certificated maximum gross takeoff weight and was within c.g. limits; however, the density altitude at the time of the takeoff was 10,000 ft m.s.l. The pilot and six of the seven passengers were killed. One passenger survived the accident but died 5 days later because of thermal injuries. Except for the postcrash fire, the accident was survivable.

Based on the aircraft flight manual, the aircraft should have had a best single-engine rate of climb of 160 fpm at a speed (Vyse) of 99 knots indicated airspeed (KIAS). This performance is predicated on the use of takeoff power on the operating engine with the landing gear and wing flaps up, the propeller on the inoperative engine feathered, a 5° angle of bank into the operative engine, and a 1/2-ball width slip deflection on the turn and bank indicator. The 160 fpm rate of climb, which was established under optimum flight test conditions, is barely discernible on the vertical climb indicator. Additionally, the manufacturer's data indicated that the climb performance of the Cessna 404 will be adversely affected by certain pilot actions. For example, a 5° bank into the inoperative engine will decrease the climb performance by 100 to 150 fpm, while a wings-level attitude would cause a 20 to 30 fpm decrease in climb performance. A 10° bank into the operative engine will decrease the climb capability by 150 to 200 fpm. Since the capability of the aircraft to climb in a single-engine configuration can be degraded by small increments of bank angle in either direction, the pilot must exercise exceptional skill to achieve the airplane's maximum performance under single-engine emergency circumstances. This fact was underscored in the Safety Board's special study 1/ on light twin-engine aircraft (nine passengers or less), wherein the Board stated "the ability to fly the aircraft in precisely the proper attitude and single-engine configuration to achieve maximum climb performance is difficult, and highly dependent on the knowledge of, and proficiency in, emergency situations."

1/ Special Study --"Light Twin-Engine Aircraft Accidents Following Engine Failures, 1972-1976 " (NTSB-AAS-79-2).

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A second similar accident occurred on March 21, 1980, when an Eagle Commuter Airlines, Inc., Piper PA-31-350, crashed after the takeoff. The accident occurred following a power loss in the right engine during a night departure. The pilot, who had considerable experience in the PA-31-350, the copilot, and five of the eight passengers were killed. The investigation revealed that the aircraft was about 90 ft above the runway and at, or just below, Vyse when power was lost. From the point where the power was lost, sufficient runway and clear zone remained to make a survivable emergency landing. However, the pilot elected to continue single-engine flight, although he did not raise the wing flaps or feather the propeller. As a result, he lost control of the aircraft, and it crashed 90° off the runway heading.

The foregoing accidents involved a critical emergency in these types of aircraft of a partial power loss at low altitude resulting in an extremely short period of time in which a pilot must decide whether or not to feather the propeller of the malfunctioning engine and take other immediate corrective actions. Pilots in this situation have allowed their aircraft to decelerate to dangerously slow speeds. Pilots, degrading the marginal single-engine performance by attempting to increase the climb of their aircraft, have lost control of the aircraft when the only realistic alternative was a controlled, straight-ahead emergency landing. The Safety Board believes that these pilots have responded improperly to single-engine emergencies because they have not prepared themselves for a power loss on takeoff. In part, this is because the performance data upon which a decision to continue the takeoff or make an emergency landing must be made has not been adequately defined or adequately understood by pilots. Additionally, some pilots apparently have not understood the necessity of establishing a zero sideslip attitude, and have exhibited difficulty controlling the yaw and roll associated with a sudden power loss.

The Safety Board believes that critical information relating to a power loss on takeoff in light, twin-engine aircraft is not stressed sufficiently in aircraft flight manuals or in pilot training programs. These manuals and programs should emphasize that a light, twin-engine aircraft which loses power on an engine shortly after takeoff will not have the capability to continue the takeoff climb unless the pilot analyzes the emergency correctly and responds immediately. The pilot must also be prepared to accept the possibility that continued single-engine flight is not possible and that a controlled emergency landing is the safest option available to him. Further, we believe it imperative that the pilots of these aircraft have complete knowledge of the critical performance data of the aircraft to enable them to determine quickly whether the aircraft has the capability to continue a single-engine climb or whether a controlled emergency landing is the safest option.

The Safety Board believes that emergency training must stress that most light, twin-engine aircraft, even when properly configured for a single-engine climb, have a marginal capability to maintain level flight at speeds below Vyse and very limited capability to climb even at airspeeds of Vyse. A pilot whose aircraft loses power on takeoff must raise the landing gear and flaps, identify and feather the propeller on the inoperative engine, and establish a 5° bank into the operative engine before the airspeed falls below Vyse. Concurrently, he will probably have to lower the nose of the aircraft to a level flight attitude, or a slightly nosedown attitude, to maintain the airspeed. Finally, each of these actions must be precise and timely because the available time, altitude, and aircraft performance leave little or no margin for error.

Realistically, a pilot needs 3 to 8 seconds to determine and accomplish the proper emergency response, during which time the aircraft can decelerate as much as 3 kns per second. Therefore, the aircraft should be accelerated to an airspeed greater than Vyse as soon as possible in order to provide the pilot w.th the opportunity to configure the aircraft properly and still maintain Vyse. The FAA, in Advisory Circular 61-21A, "Flight Training Handbook," recognizes the need for the posttakeoff attainment of an airspeed above Vyse and concludes that, ". . .the initial climb speed for a normal takeoff with both engines operating should permit the attainment of a safe single-engine maneuvering altitude as quickly as possible; it should provide for good control capabilities in the event of a sudden power loss on one engine; and it should be a speed sufficiently above Vyse to permit attainment of that speed quickly and easily in the event power is suddenly lost on one engine. The only speed that meets all of these requirements for a normal takeoff is the best rate-of-climb speed with both engines operating (Vy)."

As a result of the Safety Board's accident investigation experience and the special study on commuter airlines, we believe that the current training programs for 14 CFR 135 certificate holders do not discuss adequately the issue of emergency response to an engine loss on takeoff, or the marginal single-engine performance of light twin-engine aircraft. Furthermore, the training programs do not address adequately the specific capabilities of the aircraft used by the individual airlines. Finally, the Safety Board believes that most training programs and aircraft flight manuals do not contain sufficient data to inform the pilot of the marginal capability of many light twin-engin aircraft to maintain level flight, in a single-engine configuration, at airspeeds below Vyse.

On December 31, 1979, the Safety Board issued Safety Recommendation A-79-95, requesting that the FAA periodically disseminate additional information concerning how to manage engine failures in light twin-engine aircraft. Although the FAA responded by publishing three articles on light twin-engine operational safety, and accident prevention coordinators had conducted safety meetings with air taxi operators, it appears that the actions taken may not be sufficient. Therefore, the Safety Board reiterates the following recommendation:

> Periodically disseminate to pilots, certificated flight instructors, and FAA inspectors and their designees, additional information on how to manage light twin-engine aircraft following an engine failure, using advisory circulars, safety seminars, or other means at its disposal. (Class II, Priority Action) (A-79-95)

The Safety Board recognizes that more comprehensive aircraft flight manuals and improved pilot training and proficiency, while essential elements in a strategy to minimize accidents involving light twin-engine aircraft which experience an engine power loss during the critical takeoff regime, are not the ultimate solution to the prevention of these accidents. Therefore, the Board intends to conduct a more comprehensive investigation during which manufacturers, operators, and pilots will be solicited to assist the Board in identifying other possible and feasible corrective measures. Such measures could include standardized training, making more explicit performance data available to the pilot, and modifications of operational procedures.

As an interim measure the National Transportation Safety Board recommends that the Federal Aviation Administration:

Require that pilot training programs for 14 CFR 135 certificate holders which operate light twin-engine aircraft include specific ground and flight training in: (1) the factors related to achieving and maintaining Vyse; (2) the capability of company aircraft to maintain level flight at airspeeds below Vyse while in a single-engine configuration; (3) the capability of company aircraft to accelerate to Vyse while in a single-engine configuration; and (4) rapid appraisal of those situations in which a controlled, straight-ahead emergency landing is the safest or only option available. (Class II, Priority Action) (A-81-24)

Require that aircraft flight manuals for light twin-engine aircraft used in 14 CFR 135 operations contain data related to those conditions in which the aircraft, in a single-engine configuration and at airspeeds between Vmc and Vyse, has the capability to maintain level flight. (Class II, Priority Action) (A-81-25)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and BURSLEY, Members, concurred in these recommendations. GOLDMAN, Member, did not participate.

James B. King

By: James B. King
Chairman

AD-A105 702 FEDERAL AVIATION ADMINISTRATION WASHINGTON DC OFFICE--ETC F/G 1/2
SUMMARY OF FEDERAL AVIATION ADMINISTRATION RESPONSES TO NATIONA--ETC(U)
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National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

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AOA-1

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Reference is made to the Federal Aviation Administration (FAA) letter dated November 6, 1980, responding to National Transportation Safety Board Safety Recommendations A-79-80 and -81, A-78-27 through -29, and A-80-64 through -75. This letter is in reply to your response to our reiterated recommendations A-79-80 and -81. Our comments on your response dealing with A-78-27 and -29 and A-80-64 through -75 are being forwarded in separate letters.

In Safety Recommendation A-79-80 we proposed that the FAA require that pilots involved in 14 CFR 135 operations be thoroughly trained on the performance capabilities and handling qualities of aircraft when loaded to their maximum certificated gross weight or to the limits of their center of gravity envelope, or both. We have examined the new Federal Aviation Regulations Section 135.244, Operating Experience, effective March 1, 1980. Although this new regulation upgrades the experience of a pilot-in-command, no specific mention is made of a pilot's handling of an aircraft loaded to maximum gross weight. Instances of twin engine aircraft crashing during takeoff, after the failure of one engine, occur too frequently. The manner in which a pilot should be trained to respond to such emergencies is unclear. We request the FAA to fulfill the intent of this recommendation in a clear and positive manner. Pending its resolution, A-79-80 will be maintained in an "Open--Unacceptable Action" status.

In Safety Recommendation A-79-81 we asked the FAA to expedite rulemaking which would make the flight time and duty time limitations and the rest requirements for commuter air carriers the same as those specified for domestic air crewmembers under 14 CFR 121. We appreciate the rulemaking actions underway to fulfill this recommendation which we are maintaining in an "Open--Acceptable Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

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OFFICE OF THE ADMINISTRATOR
FEDERAL AVIATION ADMINISTRATION

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON D.C. 20591

OFFICE OF
THE ADMINISTRATOR

November 6, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations, relating to Commuter Airline operations, issued by the Board on August 8, 1980. These recommendations resulted from the Board's special investigation of the commuter industry and the elements which affect commuter airline safety. The objectives of these recommendations, for the most part, were within the scope of existing FAA programs.

As a result of its study, the National Transportation Safety Board reiterated five previously issued recommendations to the Federal Aviation Administration. The Board had been earlier advised of actions underway with respect to these recommendations. Many of these actions were developed as the result of the implementation and the issuance of amendments to Part 135 of the FAR's published at various times during calendar year 1980, or as the resolution of issues or concerns discussed during the FAA's First Commuter Air Carrier Safety Symposium held January 16 and 17, 1980. The adequacy of these actions, and other regional programs directed to commuter safety, will again be addressed at the second symposium to be held January 16 and 17, 1981. The current status of these actions is as follows:

A-79-80. Require that pilots involved in 14 CFR 135 operations be thoroughly trained on the performance capabilities and handling qualities of aircraft when loaded to their maximum certificated gross weight or to the limits of their c.g. envelope, or both.

Comment. As stated in our letter to the NTSB dated August 27, 1980, regulatory action was deemed appropriate, and, in fact, has been accomplished by the issuance of new FAR Section 135.244, Operating Experience, effective March 1, 1980. We believe the addition of this

requirement will further ensure that pilots involved in commuter operations are adequately trained in all pertinent operational areas, one of which includes aircraft handling characteristics at maximum takeoff gross weights. The FAA considers action on Safety Recommendation A-79-80 completed.

A-79-81. Expedite rulemaking which would make the flight time and duty time limitations, and rest requirements for commuter air carriers the same as those specified for domestic air crewmembers under 14 CFR 121.

Comment. Work on this project is continuing. A supplemental notice of proposed rule making was issued on August 11, 1980, (Notice No. 78-3B, copy enclosed). This supplemental notice proposes to revise the flight and duty time limitations and rest requirements for flight crewmembers utilized by domestic, flag, and supplemental air carriers, commercial operators, and air taxi operators. This supplemental notice is based upon two notices of proposed rule making issued in 1977 and 1978 as part of the FAA's Regulatory Review Program.

Preliminary FAA analysis of the comments received on the earlier notices (and specifically Notice 78-3) indicated the need for intensive review and additional conceptual development before that rulemaking action could proceed. Consequently, in view of the conceptual similarity between the flight and duty time limitations proposed in Part 135 and the proposal in Notice 78-3, when the agency issued the amendments to Part 135, it was decided to defer changing the flight and duty time limitations in Part 135 until they could be given further consideration. Accordingly, this supplemental notice proposes changes to both Part 121 and Part 135 and includes a discussion of comments received in response to Notices 78-3 and 77-17 pertaining to flight and duty time limitations.

A-78-27. Develop, in cooperation with industry, flight recorder standards (FDR/CVR) for complex aircraft which are predicated upon intended aircraft usage.

Comment. We recently updated the status of this safety recommendation in our letter of July 29, 1980. To reiterate our remarks, during August 1979 FAA received a proposed standard for a composite cockpit voice recorder/flight data recorder (CVR/FDR) from one of the major manufacturers of both CVR's and FDR's. Working with this proposed standard and other sample standards as a base, FAA has developed a proposed draft standard for a composite CVR/FDR. A new public procedure to expedite the issuance of standards for specified materials, parts, processes, and appliances used on civil aircraft was issued by FAA on June 2, 1980, with September 9 as its effective date (copy enclosed). FAA will publish its proposed standard for a composite CVR/FDR under this new procedure. A copy of the latest draft of the CVR/FDR and a copy of

draft of the CVR/FDR Standard and a copy of the new TSO procedures are enclosed. As a result of a recent NTSB recommendation, FAA is requesting SAE to develop the standard from our draft material.

A-78-28. Draft specifications and fund research and development for a low cost FDR, CVR, and composite recorder which can be used on complex general aviation aircraft. Establish guidelines for these recorders, such as maximum cost, compatible with the cost of the airplane on which they will be installed and with the use for which the airplane is intended.

Comment. The status of this recommendation was also updated in our letter of July 29, 1980. Although initially the FAA had planned to establish a regulatory project to develop an Advance Notice of Proposed Rule Making (ANPRM) for identification of appropriate standards, further review of the matter indicated that this regulatory procedure was not necessary. Research and development previously accomplished by the U.S. Army and by NASA was already being incorporated by several equipment manufacturers in their own development plans.

A-78-29. In the interim, amend 14 CFR to require that no operation (except for maintenance ferry flights) may be conducted with turbine-powered aircraft certificated to carry six passengers or more, which require two pilots by their certificate, without an operable CVR capable of retaining at least 10 minutes of intracockpit conversation when power is interrupted. Such requirements can be met with available equipment to facilitate rapid implementation of this requirement.

Comment. We also updated the status of this recommendation in our July 29, 1980, letter as follows: "In partial fulfillment of this recommendation, 14 CFR 135 was amended, as published October 10, 1978, in Vol. 43 FR 46742, to require under Section 135.151 (copy enclosed) that no person may operate a turbojet airplane having a passenger seating configuration, excluding any pilot seat, of 10 seats or more, unless it is equipped with an approved cockpit voice recorder.

"In further fulfillment of this recommendation, the FAA currently is drafting an NPRM which would require under Part 91, General Operating and Flight Rules, several additional equipment items, including a CVR on all multiengine turbojet airplanes. This would expand the coverage under Section 135.151 since there would be no minimum seating requirement specified." The FAA will continue to keep the Board advised of progress relating to these recommendations.

In addition to reiterating these five recommendations, the Board made twelve additional recommendations. The Board was previously advised that the FAA had initiated or completed actions which satisfied the intent of several of these safety recommendations.

A-80-64. Establish a separate classification of commuter airline inspectors to conduct commuter airline surveillance.

Comment. A separate classification was established within the FAA GS-1825 classification guide well in advance of the issuance of this recommendation. This classification for Principal Aviation Safety Inspectors emphasizes experience requirements for the certification and surveillance of commuter airlines. This guide is currently being used in the job classification of these inspectors. (A copy of the applicable announcements are enclosed.) We consider action on Safety Recommendation A-80-64 completed.

A-80-65. Provide specialized training for inspectors assigned to commuter airlines to insure that inspectors are qualified in the equipment operated and are knowledgeable regarding commuter airline operations.

Comment. The FAA agrees with this recommendation and has initiated additional training courses for this purpose. Specialized training is being provided for inspectors assigned to commuter airlines at the Mike Monroney Aeronautical Center at Oklahoma City. Course 21618, Air Carrier Airworthiness Indoctrination (ACAI), is for general aviation inspectors and is made up of selected subjects from the air carrier inspectors indoctrination course. It was initiated in FY-79 in response to revised Part 135. Eighty inspectors completed this course in FY-79/80 and 16 inspectors are scheduled for FY-81. The second, Course 21828, Air Taxi Certification and Surveillance, covers certification requirements, operating rules, aircraft, equipment, policies, and procedures. This course was developed for airworthiness inspectors assigned to commuter airlines. In FY-79/80, the FAA trained 48 inspectors in Course 21828 and 36 inspectors are scheduled for FY-81. There are two courses for operational inspectors: Course 22100, Air Taxi Operations Certification and Inspection; and Course 21617, Air Carrier Mini Indoctrination. One hundred and seventy inspectors completed Course 22100 in FY-79/80 and 40 inspectors completed Course 21617 in FY-80 (the first year that this course was offered). For FY-81, Course 22100 has 70 inspectors scheduled for attendance and Course 21617 has 36 inspectors scheduled. With regard to flight training and qualifications, a continuing effort is being made to qualify all commuter inspectors in at least one turboprop aircraft and, where applicable, specific turbojet aircraft under their surveillance. This should be viewed as a continuing program due to such factors as manpower and fiscal restraints and personnel turnover. The FAA considers action on Safety Recommendation A-80-65 completed.

A-80-66. Allocate GADO resources to insure that all commuter surveillance and general aviation requirements can be accomplished.

Comment. 127 Flight Standards Aviation Safety Inspector positions were allocated for the FY 1981 budget appropriation. Due to a pressing need, 50 of these positions were advanced to the FY 1980 budget, and these positions have all been filled. The additional 77 positions will be filled during FY 1981. All of the 127 positions are dedicated to commuter/air taxi certification and surveillance activities. The FAA considers action on Safety Recommendation A-80-66 completed.

A-80-67. Establish a procedure for distributing surveillance of commuter airline maintenance evenly during all periods when maintenance is performed.

Comment. The FAA is in agreement with the intent of this recommendation and we believe it will be satisfied by events in progress. Work assignments for inspectors is a function of district office supervision, which provides the greatest flexibility for effective utilization of those personnel. The headquarters and regional offices periodically emphasize the need for specific surveillance by notices, such as N 8000.198, Increased Surveillance for Operator Under New Part 135 (copy enclosed).

Inspector personnel assigned to commuters have borne a time-consuming workload in the recertification of those operators under the new Part 135. With this workload behind us and hiring of new inspectors for commuter assignments now in progress, coupled with the commuter-oriented inspector programs, sufficient inspector manpower should be provided to accommodate scheduling off-hour surveillance of commuter maintenance activities. We will keep the Board advised of the results of our efforts in this regard.

A-80-68. Require that only actual passenger weights be used in weight and balance computations for reciprocative engine aircraft used in Part 135 flights which are certificated for nine or less passengers.

Comment. This was accomplished on an interim basis by internal notices culminating April 1, 1980. Final implementation of this recommendation is by Advisory Circular, AC 120-27A, Weight and Balance Control, issued May 14, 1980, and by internal instructions to FAA airworthiness inspectors, which are under development. The thrust of FAA's efforts in this area is to cause the certificate holders to develop suitable weight and balance control systems that can be easily managed by pilots or other personnel responsible for loading, in accordance with methods and procedures provided by the respective certificate holder. The FAA considers action on Safety Recommendation A-80-68 completed.

A-80-69. Amend 14 CFR 135.243 to require a minimum number of multiengine flight hours for a pilot-in-command of a multiengine commuter airline flight.

Comment. In February 1980, new Section 135.244, commuter pilot-in-command operating experience requirements, was issued, which contained standards for pilots prior to designation as pilot-in-command on commuter passenger-carrying operations. These requirements established increased operating experience levels by make and model for both single and multiengine aircraft. This experience, which varies depending on whether the aircraft is piston or turbine powered, must be acquired under the supervision of a check airman employed by the certificate holder in passenger-carrying operations. The intent of this rule is to upgrade

pilot experience to adhere to a higher level of safety. A copy of this new section is enclosed for your review. Also, it should be stressed that this new section specifies requirements in addition to those in Section 135.243, which require all pilots serving in commuter operations to hold an airline transport pilot certificate. This requirement in itself, in our judgment, contributes appreciably to pilot-in-command experience, especially when complemented by the provisions of new Section 135.244. Finally, we believe the increased training program requirements contained in Subpart H of Part 135 are also a positive factor. In this regard, the operating experience under Sections 135.244 must be acquired only after satisfactory completion of the appropriate ground and flight training for the aircraft and crewmember position. Approval provisions for the operating experience must be scheduled in the operator's training program. We consider action on Safety Recommendation A-80-69 completed.

A-80-70. Amend 14 CFR Subpart B to require that dispatch and flight operations duties are supervised by personnel trained in those functions.

Comment. Due to the relative size and scope of Part 135 commuter operations, we do not, at this time, believe there is a need for a flight dispatcher as indicated in Part 121 operations. We will, of course, continue to monitor this situation for possible changes in future operations. With regard to flight operating personnel qualifications and training, we believe the current regulations are adequate. The qualification requirements for supervisory personnel are adequate to achieve the intended level of safety. Section 135.37, Management Personnel Required, requires a qualified director of operations, chief pilot, and director of maintenance. Section 135.39 specifies the qualifications that persons occupying these positions must possess. Also, Section 135.77, Responsibility for Operational Control, requires each certificate holder to list in his operating manual the name and title of each person authorized to exercise operational control. Accordingly, the FAA intends to take no further steps in this area at this time, and we consider action on Safety Recommendation A-80-70 completed.

A-80-71. Amend CFR 135.185 to require that aircraft empty weight, and that center of gravity be determined more frequently.

Comment. The FAA agrees with the intent of this proposal as it regards the importance of aircraft empty weight, operating weight, and corresponding centers of gravity (c.g.). However, we believe a well developed cumulative weight control system is the primary means of controlling operating weight and c.g. This system continuously updates operating weights and c.g.'s (or other aircraft weight references) to account for changes to the aircraft, its equipment, or standard passenger provisions such as stewardess supplies. Periodic reweighing of aircraft under

approved programs serves to confirm the cumulative weight control system. Section 185 provides for the use of approved weight and balance control systems for multiengine aircraft which includes cumulative weight control. These programs include periodic reweighing requirements for aircraft controlled on a fleet basis, as well as aircraft handled individually. In the case of aircraft fleets, aircraft within each fleet are weighed on a sampling basis to confirm the fleet weight and c.g. Therefore, reweighing periodically is imposed on the fleet rather than on individual aircraft.

Advisory Circular 120-27A, Weight and Balance Control, was issued May 18. This circular consolidates previous advisory circulars for air taxis and large air carriers, and includes cumulative weight control procedures as well as aircraft reweigh periods. The superseded advisory circular for air taxis did not include a periodic reweigh period. We do not believe further steps in this area are appropriate at this time and, accordingly, the FAA considers action on Safety Recommendation A-80-71 completed.

A-80-72. Evaluate and revise as appropriate the criteria for the authorization of single-pilot IFR operations for commuter airlines.

Comment. The FAA concurs with Safety Recommendation A-80-72. Section 135.105 was amended, effective March 1, 1980, to require that, prior to authorizing single pilot IFR operations, the pilot-in-command must have previously logged 100 pilot-in-command hours in the make and model aircraft to be flown. This increased pilot experience requirement would ensure that the pilot has aircraft familiarity and proficiency sufficient to adequately cope with IFR operational problems and to handle inflight emergencies. We consider action on Safety Recommendation A-80-72 completed.

A-80-73. Expand the ADAP program to support the development of commuter-served airports.

Comment. In 1976, Amendments to the Airport and Airway Development Act of 1970 defined commuter airports for the first time and provided specific funding for their development. In the administration of the Airport Development Aid Program (ADAP), the FAA, through use of an authorized discretionary fund, has consistently granted more for commuter airport development annually than the $15 million identified in the Act for use at commuter locations (FY 1976, $19.9M; FY 1977, $23.9M; FY 1978, $19.9M; FY 1979, $30.7M; and FY 1980, $21.6M).

The Administration's legislative proposal to continue an airport grant program beyond the September 30, 1980, expiration of the ADAP was developed to provide a single fund for development of all commercial service (including commuter) airports. This will allow greater emphasis to be placed on improvement of commuter airports in the post-1980

program. The latest House and Senate legislative proposals require administration of the facilities and equipment and airport development programs in a manner to maximize the use of safety facilities with highest priority for commercial service airports. This includes, but is not limited to, installation, operation, and maintenance of precision approach systems for each primary runway; grooving or friction treatment of all primary and secondary runways; nonprecision approaches for secondary runways; and electronic or visual vertical guidance on all runways.

We believe the FAA's ADAP program has been administered to support the development of commuter-served airports, and that future programs though subject to legislative approval, have also been designed to support commuter airports, and, accordingly, no further action is presently intended. The FAA, therefore, considers action on Safety Recommendation A-80-73 completed.

A-80-74. Revise the qualifying criteria to insure that a larger percentage of commuter-served airports are equipped with instrument landing systems.

Comment. An extensive evaluation of the instrument landing system (ILS) qualifying criteria was initiated. This evaluation includes a reassessment of the benefits derived from an ILS by all categories of aviation, including trunk carriers, commuter carriers, air taxi carriers, general aviation, and military. Completion of this evaluation is anticipated in the near future. We will advise the Board of the results of this evaluation as soon as they are available.

A-80-75. Insure, to the extent possible, that airports which are served by commuter airlines are equipped with an instrument approach facility.

Comment. In February 1980 the FAA initiated an indepth analysis of all airports served by commuter airlines in the continental U.S. and Hawaii which found that 64 percent have a commissioned or programmed instrument landing system (ILS). Commuter needs at the remaining commuter-served airports are being investigated. Recommendations regarding the installation of ILSs at specific airports are anticipated in the near future and will be made available to the Board when available.

In summary, the FAA considers action completed on Safety Recommendations A-80-64, -65, -66, and -68 through -73. We intend to provide further response to the Board on Recommendations A-80-67, -74, and -75.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosures

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

August 27, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to your letter of July 9 and supplements our letter of January 15 to NTSB Safety Recommendations A-79-80 and 81.

A-79-80. Require that pilots involved in 14 CFR 135 operations be thoroughly trained on the performance capabilities and handling qualities of aircraft when loaded to their maximum certificated gross weight or to the limits of their c.g. envelope, or both.

Comment. An amendment to 14 CFR Part 135, Amendment No. 135-3, issued January 30 requiring additional operating experience for commuter pilots-in-command, was effective March 1. A notice providing specific flight testing standards for Part 135 pilots was issued on January 14 and should result in pilots being more knowledgeable about their aircraft and its limitations. Copies of both are enclosed.

The revised Part 135 provides training in weight and balance, runway limitations for takeoff and landing, aircraft performance data, and operating limitations during initial, transition, and upgrade ground training for pilots. In April 1979, increased Part 135 surveillance requirements were initiated which involved additional en route inspections and other FAA emphasis items. Crewmembers demonstrated their knowledge of weight and balance procedures and aircraft performance as part of the surveillance.

In the transmittal letter of October 17, 1979, the NTSB stated it would be impractical to accomplish flight training in an aircraft loaded to gross weight or at c.g. limits, but that pilots should nevertheless be thoroughly familiar with performance at maximum certificated gross takeoff weight and have training under conditions at or near gross weight, etc.

The revised training and testing requirements and the exposure to various weight and loading conditions that the pilot will receive during the acquisition of operating experience now required in Amendment No. 135, will provide the needed additional familiarization and knowledge of aircraft performance deficiencies. We believe these actions fulfill the intent of Safety Recommendation A-79-80.

A-79-81. Expedite rulemaking which would make the flight time and duty time limitations and rest requirements for commuter air carriers the same as those specified for domestic air carrier crewmembers under 14 CFR 121.

Comment. On August 4, 1980, the FAA issued a supplemental Notice of Proposed Rule Making (NPRM) No. 78-3B, Docket No. 17669, to revise the flight and duty time limitations and rest requirements for flight crewmembers utilized by domestic, flag, and supplemental air carriers, commercial operators, and air taxi operators. I am enclosing a copy of the NPRM for the Board's review and records.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

3 Enclosures

National Transportation
Safety Board

Washington D.C. 20594

Office of
Chairman

July 9, 1980

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to the National Transportation Safety Board Safety Recommendations A-79-80 and A-79-81 issued October 17, 1979. These recommendations, which stemmed from the Safety Board's investigation of several commuter air carrier accidents, pertained to:

1. Pilots' handling of aircraft loaded to maximum gross weight.

2. Flight and duty time limitations for operations under FAR Part 135.

The Federal Aviation Administration's response of January 15, 1980, indicated actions were in progress to resolve these recommendations. To better evaluate their progress and update the public docket, we would appreciate a further report of actions taken.

Sincerely yours,

James B. King

James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

February 7, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of January 15, 1980, responding to the National Transportation Safety Board's Safety Recommendations A-79-80 and 81. Our comments to your response are as follows:

A-79-80. The Safety Board is pleased to note that the Federal Aviation Administration (FAA) is proposing regulatory action to upgrade the operating experience and testing standards of Part 135 pilots. Pending the revision of the rules, A-79-80 is classified in an "OPEN--ACCEPTABLE ACTION" status.

A-79-81. It is also noted that the FAA will shortly issue Notice No. 78-3B to provide identical flight and duty time limitations for Parts 135 and 121 operations. Pending regulatory action, A-78-81 is also being maintained in an "OPEN--ACCEPTABLE ACTION" status.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

January 15, 1980

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-79-80 and 81 issued on October 17, 1979. These recommendations are based on the Board's concern that the expansion of 14 CFR 135 operations, and particularly commuter air carrier operations, be accompanied by measures to assure a level of safety comparable with that of the air carriers certificated under 14 CFR 121. These recommendations would deal with certain aspects of pilot training and with crew flight time, duty time, and rest requirements. The following are the Federal Aviation Administration's (FAA) comments and actions in response to these recommendations.

A-79-80. Require that pilots involved in 14 CFR 135 operations be thoroughly trained on the performance capabilities and handling qualities of aircraft when loaded to their maximum certificated gross weight or to the limits of their c.g. envelope, or both.

Comment. The FAA is in the process of amending Part 135 to require operating experience similar to that required in Part 121 for any pilot prior to designation as pilot-in-command on commuter air carrier operations. This operating experience would expose the pilot to various gross weight operations for each make and model aircraft to be flown. This operating experience will be acquired under the supervision of a company check pilot. The estimated completion date for this regulatory action is March 1, 1980.

In addition, we are issuing a directive that will be more specific as to testing standards regarding pilots as stated in Part 135. Although present training and testing requirements cover aircraft performance, this additional directive will cover this area in more detail. Estimated completion date for this directive is February 1, 1980.

A-79-81. Expedite rulemaking which would make the flight time and duty time limitations, and rest requirements for commuter air carriers, the same as those specified for domestic air carrier crewmembers under 14 CFR 121.

Comment. Considerable work has been done on amending the present flight and duty time requirements for both 14 CFR 135 and 14 CFR 121 to provide compatible requirements. The final draft of the Notice of Proposed Rule Making does provide for identical requirements for Parts 135 and 121. The Supplemental Notice of Proposed Rule Making, Notice No. 78-3B, on this subject, should be issued by the end of March 1980.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: October 17, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-80 and -81

The air taxi industry, particularly the commuter air carrier segment, has enjoyed tremendous growth in recent years. U.S. commuter airlines have gained an average of 10 percent more passengers and 30 percent more freight each year since 1970. Commuter air carrier revenue passenger miles have increased from 750,048,000 in 1975 to 1,145,000,000 in 1978. The FAA has forecast a 116 percent increase in commuter passenger enplanements between fiscal 1978 and 1989. This forecast growth of the air taxi industry has prompted aircraft manufacturers to produce new and larger aircraft.

However, this expansion has been accompanied by a corresponding rise in commuter air carrier accident fatalities. For example, in the first 7 months of 1975 there were 27 commuter air carrier accidents which included 9 fatal accidents and 24 fatalities. During the first 7 months of 1979 there have been 27 commuter air carrier accidents including 10 fatal accidents and 48 fatalities.

In the past 2 years, the National Transportation Safety Board has investigated numerous commuter accidents in which the aircraft was at or above its maximum certificated gross weight or at or beyond its center of gravity (c.g.) envelope, or both 1/. In all of these accidents, pilots were confronted with the two-fold problem of unfavorable weight and balance and mechanical malfunction. Safety Board investigations of

1/ Aircraft Accident Report: Rocky Mountain Airways, DHC-6, Cheyenne, Wyoming, February 27, 1979. (NTSB-AAR-79-10)
Aircraft Accident Report: Columbia Pacific Airlines, Beech 99, Richland, Washington, February 10, 1979. (NTSB-AAR-78-15)
Aircraft Accident Report: Antilles Air Boats, G-21A, St. Thomas, Virgin Islands, April 5, 1978. (NTSB-AAR-79-9)

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these accidents also revealed that the pilots had received no flight or ground training on the performance capabilities and handling qualities of the aircraft when loaded to its maximum certificated gross weight or at the limits of its c.g. envelope.

On March 1, 1979, a commuter air carrier flight, a Beech Model 70, Excalibur conversion, crashed during takeoff at the Gulfport-Biloxi Regional Airport, Gulfport, Mississippi. The investigation revealed that the aircraft was over its maximum certificated gross weight, and out of its c.g. envelope. It also revealed uncorrected maintenance discrepancies, that the ADF and wing flaps were inoperative, and that the starter interrupt system had been bypassed. Further, it revealed that aircraft dispatch operations were hurried and that, in particular, data for weight and balance computations were carelessly compiled. Moreover, the pilot had received no training on the performance capabilities and handling qualities of the aircraft under high gross weight conditions. The accident illustrates a typical result of poor operational practices and incomplete training. The pilot had flown the aircraft earlier that day at its maximum weight for the first time even though it was on a regularly scheduled, unsupervised passenger flight.

Safety Board investigative experience has disclosed also that air taxi/commuter flights are often conducted at high gross weights. Many of the aircraft used by these operators exhibit flight characteristics and handling qualities at high gross weights that are markedly different from those exhibited at lower gross weight.

While it may be impractical to accomplish flight training in aircraft loaded to the maximum gross weight or at the limits of the c.g. envelope, all pilots should be thoroughly familiar with the performance deficiencies which could be produced by such conditions and have training under conditions approaching these limits. Such performance deficiencies may include an increase in takeoff speed, a longer takeoff roll, a reduction in the rate and angle of climb, and a higher stall speed. These deficiencies may be compounded further by an aircraft malfunction, such as an engine failure. Training regarding these factors would have alerted the pilot in the Gulfport accident to the importance of proper weight and balance for safe flight and he might have required accurate computations to be made.

The Safety Board is aware that the Federal Aviation Administration is currently evaluating comments on NPRM 78-3, "Flight Crewmember Flight and Duty Time Limitations and Rest Requirements," as they apply to 14

CFR 121 operations. However, recent commuter air carrier accidents have given added urgency to the need to revise the crew duty time, flight time, and rest period regulations contained in 14 CFR 135 2/.

The Safety Board believes that the expansion of 14 CFR 135 operations, and particularly commuter air carrier operations, to more closely approximate those of air carriers certificated under 14 CFR 121, should be accompanied by measures to assure a comparable level of safety. Differences in the types of operational activities usually conducted by a commuter air carrier pilot are other factors which support a need for such changes. Commuter air carrier flights are usually short, and during a long-duty day a pilot can be required to make numerous approaches and landings, and numerous instrument approaches -- often conducted as single pilot IFR operations. The commuter air carrier pilot may be required to perform collateral duties such as baggage handling and aircraft refueling. These factors can all contribute to pilot fatigue, with a possible resultant deterioration of basic flying skills and judgment.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Require that pilots involved in 14 CFR 135 operations be thoroughly trained on the performance capabilities and handling qualities of aircraft when loaded to their maximum certificated gross weight or to the limits of their c.g. envelope, or both. (Class-II, Priority Action) (A-79-80)
>
> Expedite rulemaking which would make the flight time and duty time limitations, and rest requirements for commuter air carriers the same as those specified for domestic air carrier crewmembers under 14 CFR 121. (Class-II, Priority Action) (A-79-81)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, BURSLEY, and GOLDMAN, Members, concurred in these recommendations.

James B. King

By: James B. King
Chairman

2/ Aircraft Accident Report: Universal Airways, Beech 70, Gulfport, Mississippi, March 1, 1979. (NTSB-AAR-79-16)
Aircraft Accident Report: Columbia Pacific Airlines, Beech 99, Richland, Washington, February 10, 1978. (NTSB-AAR-78-15)
Air New England, DHC-6, Yarmouthport, Massachusetts, June 17, 1979. (Currently under investigation)

National Transportation
Safety Board

Washington, D.C. 20594

Office of the
Chairman

May 27, 1980

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of March 28, 1980, responding to National Transportation Safety Board Safety Recommendations A-79-94 through A-79-97, issued December 31, 1979. These recommendations stemmed from the Safety Board's Special Study entitled "Light Twin-Engine Aircraft Accidents Following Engine Failures, 1972-1976." The study revealed that from 1972 through 1976 477 light twin-engine accidents followed engine failures, 123 of which were fatal. The percentage of fatal light twin-engine accidents following engine failures was four times that for single-engine aircraft.

Recommendations A-79-94 and 95 called upon the Federal Aviation Administration (FAA) to determine whether pilot handbooks for light twin-engine aircraft needed more information regarding single-engine performance at minimum control airspeed. It was also recommended that pilots be advised periodically on how to manage a light twin-engine aircraft after one engine fails. Based on our evaluation of the FAA's actions, both of these recommendations are placed in a "Closed--Acceptable Action" status.

Recommendations A-79-96 and 97 called upon the FAA to amend 14 CFR Part 61.57 to ensure that pilots-in-command of light twin-engine aircraft have recent flight experience and have demonstrated their ability to execute maneuvers after the loss of engine power. The Safety Board is pleased to note that the FAA will conduct a review of the regulations to identify areas of potential revision. Pending the completion of this action, both these recommendations are being maintained in an "Open--Acceptable Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

March 28, 1980

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-79-94 through 97 issued by the Board on December 31, 1979. These recommendations were based on a detailed study by NTSB of its data files of accidents following engine failures or malfunctions in light twin-engine aircraft that occurred from 1972 through 1976. Records were reviewed to determine the specific acts of omission or commission by the pilot or deficiencies in the aircraft that led to the acts and why they were not overcome. Handbooks and other materials available to pilots which provide information on engine-out performance and emergency procedures in light twins were reviewed to determine if such information was adequate to enable the pilot to cope with these emergencies.

In its December 31 transmittal letter, the Board stated that pilot-operating handbooks have been improved over the years and generally provide the necessary information regarding single-engine performance. It made reference to excellent supplemental publications by FAA and industry covering the same subject areas.

The Board expressed its concern that these guidance materials are not being utilized to the extent necessary for pilots to remain knowledgeable, and has recommended several actions related to such materials and to pilot flight reviews.

The following are the FAA's comments and actions in response to these recommendations:

A-79-94. Examine pilot handbooks for light twin-engine aircraft to determine if, for certain models, there is a need for any additional explanatory information, especially regarding single-engine performance and normal operation of the aircraft below V_{mc} and provide any such information to all pilots through accident prevention notices or other means at its disposal.

A-79-95. Periodically disseminate to pilots, certificated flight instructors, and FAA inspectors and their designees, additional information on how to manage light twin-engine aircraft following an engine failure, using advisory circulars, safety seminars, or other means at its disposal.

Comment. We have examined pilot handbooks for light twin-engine aircraft and believe there are sufficient single-engine performance data included. There are no data concerning single-engine performance and normal operation of aircraft below Vmc since there cannot be any performance below minimum control airspeed, nor can there be normal operations of aircraft below minimum control airspeed.

We have already taken the actions proposed in these recommendations concerning the dissemination of information on light-twin aircraft. The Accident Prevention Staff has published detailed information on the subject of light-twin operational safety. This information is presented in the articles entitled, "Always Leave Yourself An Out" and "Flying Light Twins Safely." Approximately 100,000 of these articles have been distributed to the field and made available to pilots, flight instructors, designated pilot examiners, and air taxi operators through the Accident Prevention Program. On December 13, 1979, all Accident Prevention Coordinators were asked to conduct safety meetings with air taxi operators on the problem areas discussed in the two articles mentioned above (copies enclosed).

Additionally, the enclosed January 1980 issue of FAA General Aviation News carried an article, "One Engine Out," which provides information on the subject of single-engine performance in light twins. All of the above-referenced publications contain explanatory information not required by aircraft certification regulations, or normally found in manufacturers' pilot-operating handbooks.

Dissemination of the kind of information discussed in these recommendations is an ongoing part of the FAA Accident Prevention Program. Accident Prevention Specialists have been provided with slide/tape presentations on the subject for use in safety meetings and seminars.

A-79-96. Amend 14 CFR Part 61.57 to require that to act as pilot-in-command of a multiengine aircraft a person must have successfully completed, within the last 24 months, a flight review in a multiengine aircraft.

A-79-97. Amend 14 CFR Part 61.57 to require that during the multiengine flight review, the pilot demonstrates the maneuvers that are required for a multiengine proficiency check in accordance with the flight test guide, especially those maneuvers related to power loss.

Comment. We are conducting an internal review of 14 CFR Part 61 to identify areas of potential revision. During this review, we will study the recommended changes to Part 61.57.

The FAA has included NTSB Recommendations A-79-96 and A-79-97 in the agenda for consideration during the update of 14 CFR Parts 61 and 141.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosures

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: December 31, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-94 through -97

The National Transportation Safety Board has studied its data files of accidents following engine failures or malfunctions in light twin-engine aircraft (light-twins) that occurred from 1972 through 1976. 1/ The complete records of accidents thought to be particularly relevant and enlightening were studied in detail to determine the specific acts of omission or commission by the pilot or deficiencies in the aircraft that led to the acts and why they were not overcome. Pilot or owner handbooks and other materials available to pilots which provide information on engine-out performance and emergency procedures in light-twins were reviewed. These reviews were performed to determine if such information was adequate to enable the pilot to cope with these emergencies. A limited number of interviews were conducted with light-twin pilots, certificated flight instructors, and FAA-designated check pilots to gain some insight into their knowledge, attitudes, and perceptions regarding management of power loss in light-twins.

From 1972 through 1976, there were 477 light-twin accidents following engine failures, 123 of which were fatal, accounting for the loss of 289 lives. The percentage of fatal light-twin accidents following engine failures is more than four times that in single-engine aircraft. Probably contributing to this substantial difference in the percentage of fatal accidents is the considerably higher average cruise speeds, stall speeds, and generally greater weight of the light-twins, resulting in more severe crashes.

The data show that the accident rate in light-twins is much lower in the category involving professional flying than it is for the category involving primarily nonprofessional flying. Also, landing types of accidents are the most prevalent kind of accidents following engine failure; however, they are almost never fatal. Stalls, collisions with the ground or water, and collisions with obstacles account for 92 percent of the fatal accidents following engine failures.

1/ For more detailed information read "Special Study--Accidents Following Engine Failures in Light Twin-Engine Aircraft, 1972-1976" (NTSB-AAS-79-2).

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There is a relationship between the rate of occurrence of accidents following engine failures in light-twins and the power loading (ratio of gross weight to horsepower) of these aircraft. The Safety Board believes that this relationship should be considered carefully by the FAA in reviewing current airworthiness regulations and when drafting new regulations, especially in regard to 14 CFR Part 135 operations, where the increased use of light-twins for revenue-producing operations presents increased potential for serious consequences. The Safety Board also believes that the general aviation aircraft manufacturers should be cognizant of this apparent relationship when designing new light-twins.

The pilot operating handbooks have been improved over the years and now generally provide most of the information regarding single-engine performance of light-twins and emergency procedures necessary for coping with power loss; however, some of the graphs or charts used to present some performance data in the handbooks are difficult to understand. There is excellent supplemental information in the form of FAA and industry publications and articles presented in the aviation media regarding the hazards of, and the techniques for coping with, power loss in light-twins. The pilot handbooks and supplemental materials which are available are apparently not utilized to the extent necessary for pilots to remain knowledgeable about their aircraft's engine-out performance and the procedures for coping with the emergency.

The pilot total time and time-in-type data suggested that accidents in light-twins following engine failures are not unique to low-time pilots. Further, accidents following engine failures in light-twins generally involve a lack of proficiency in responding to these emergencies. Often these accidents involve some degree of panic, probably related to inadequate immediate recall of the exact emergency procedures or lack of confidence in one's ability to execute the emergency procedures.

It was not possible to assess, in sufficient detail, the precise role of the pilot in these accidents because of the lack of appropriate flight exposure data. The Safety Board concludes that the FAA should begin to collect adequate pilot exposure data.

Based on the results of this study, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Examine pilot handbooks for light twin-engine aircraft to determine if, for certain models, there is a need for any additional explanatory information, especially regarding single-engine performance and normal operation of the aircraft below V_{mc} and provide any such information to all pilots through accident prevention notices or other means at its disposal. (Class II, Priority Action) (A-79-94)
>
> Periodically disseminate to pilots, certificated flight instructors, and FAA inspectors and their designees, additional information on how to manage light twin-engine aircraft following an engine failure, using advisory circulars, safety seminars, or other means at its disposal. (Class II, Priority Action) (A-79-95)

> Amend 14 CFR Part 61.57 to require that to act as pilot-in-command of a multiengine aircraft a person must have successfully completed, within the last 24 months, a flight review in a multiengine aircraft. (Class II, Priority Action) (A-79-96)
>
> Amend 14 CFR Part 61.57 to require that during the multiengine flight review, the pilot demonstrate the maneuvers that are required for a multiengine proficiency check in accordance with the flight test guide, especially those maneuvers related to power loss. (Class II, Priority Action) (A-79-97)

The Safety Board also reiterates its recommendation of May 31, 1979, that the Federal Aviation Administration:

> Generate, through a stratified sampling of general aviation pilots, the date, duration, aircraft make and model, the geographical location of the flight, and the flight time in IFR, high density altitude, and wind conditions, all on a per flight basis; the data collected should include the pilot's total time, time in each type aircraft flown, age, occupation, certificate, and medical waivers. (Class II, Priority Action) (A-79-44)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in the above recommendations.

James B. King
James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

June 18, 1981

The Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-81-26 through A-81-28 issued March 20, 1981. These recommendations resulted from the Board's investigation of several accidents involving emergency exit problems on small airplanes.

A-81-26. Amend 14 CFR 23.783 to require that each external door on all aircraft manufactured after a specified date can be opened using only one handle or latching mechanism and that the means of operation be simple and apparent.

A-81-27. Amend 14 CFR 23.807(a)(1) to require all aircraft with a seating capacity of two or more, excluding aircraft with canopies, manufactured after a specified date to have at least one emergency exit located on the opposite side of the cabin from the main door and to require that each emergency exit can be opened from both the inside and the outside of the aircraft.

A-81-28. Amend 14 CFR 23.783, 14 CFR 23.807(b)(3), and 14 CFR Part 91 to require external doors and emergency exits of aircraft to be conspicuously marked on the outside with directions for opening the door.

FAA Comment. The rules the Board has recommended may be technically feasible, but the data provided with the recommendations are not sufficient either to substantiate or to justify the additional rules. We will investigate the potential safety benefits and economic impact of the Board's recommendations. Upon completion of our investigation, we will evaluate the need for, as well as the relationship of the probable costs and expected safety benefits of, the rulemaking actions recommended by the Board. We plan to keep the Board advised on significant progress on this investigation.

Sincerely,

Helms

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 20, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-26 through -28

On June 4, 1977, a Piper PA-28-140 Cherokee crashed near Lavina, Montana, while attempting to take off from a narrow unpaved country road. The aircraft departed the road at a bend and struck an embankment. Family members and local residents who were watching the takeoff arrived moments after the accident. They observed at least one occupant alive. She was unable to extricate herself and was asking for assistance. Repeated attempts were made to open the cabin door and break out the windows. Shortly thereafter, a small fire erupted and quickly spread to the cabin. Efforts to contain the fire with a portable chemical fire extinguisher were unsuccessful, and the occupants died in the fire.

The National Transportation Safety Board's investigation of the accident disclosed aircraft design features which can seriously compromise occupant survival and rescue. Safety Board accident records from 1975 through 1978 revealed five other Cherokee accidents in which emergency egress difficulties were experienced. These five accidents accounted for 2 fatalities and 13 injuries. Summaries of these five accidents are as follows:

On July 5, 1975, a Piper PA-28-160 experienced an engine failure while flying along a beach area near Ruskin, Florida. Since there were people on the beach the pilot ditched the aircraft in the water. The aircraft immediately took on water and sank. The pilot stated that the door was jammed. Fortunately, the three occupants were able to swim out of the aircraft through the windshield which had broken on impact.

On August 26, 1975, near Whittier, Alaska, the right wingtip of a PA-28-180 struck a tree shortly after takeoff. The aircraft rolled to the right and impacted inverted. A fire erupted immediately. The two passengers in the rear of the cabin escaped by kicking out a window. Once outside the aircraft they heard a cry for help from within. Rescuers arrived shortly thereafter and contained the fire sufficiently with a handheld fire extinguisher so that they could remove the right front seat occupant. The pilot was not rescued. The survivors sustained burn injuries.

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A similar egress was made by the pilot of a PA-28-140 which crashed while attempting a crosswind landing on July 1, 1976, near Memphis, Tennessee. The pilot stalled the aircraft during an attempted go-around and struck power lines and trees. The aircraft impacted inverted and caught fire immediately. The pilot, unable to open the door, kicked out the window and escaped. He received second- and third-degree burns.

On August 7, 1976, a PA-28R-200, while executing a tight turn on final approach at Oshkosh, Wisconsin, developed a high sink rate and touched down almost simultaneously on the aircraft's right main gear, nose gear, and right wingtip. The aircraft bounced and the gear collapsed on the second touchdown. The aircraft skidded, flipped over, caught fire, and burned. The two front seat occupants escaped by kicking out a back window. The third occupant died in the fire.

The fifth accident involved a PA-28-151 which crashed on July 30, 1977, 1/2 mile short of runway 24 while attempting to land in marginal weather conditions at Martha's Vineyard Airport. The aircraft clipped the tops of the trees and impacted the ground inverted. A fire erupted immediately. The passenger door was either jammed or blocked by a fallen tree. Nevertheless, all four persons aboard, although severely burned, escaped from the burning aircraft through a broken window on the right side of the cabin.

The cabin door on the Cherokee, like several other single-engine aircraft designed for five or less persons, is the only available exit. Therefore, when the cabin door becomes jammed, blocked, or otherwise unusable during an accident, there are no alternate means of egress. Furthermore, the Cherokee door is designed with two separate latches: a locking latch located on the rearward side of the door, and a safety latch at the center top of the door which should be latched prior to flight to provide a proper seal around the door. The prompt location and operation of the top safety latch can be difficult for occupants and rescuers alike. If the occupants have not been briefed on the operation of the Cherokee door and/or their experience has been with doors with only one latch or handle, they could easily overlook the top latch. Also, rescue personnel unfamiliar with the Cherokee door may not be aware of the additional latch at the top of the door. This latch is not clearly marked and, to those who are not familiar with it, may go unnoticed in an emergency.

It is not the Safety Board's purpose to single out the Piper Cherokee as presenting a singular problem; other single-engine aircraft have just one exit. The Cherokee was identified for study as a result of its recent accident history. These accidents alerted the Safety Board to the unique Cherokee door design and the hazards associated with all single-exit aircraft in a postcrash environment, particularly one involving fire or water.

An entry door meeting the requirements of CAR 3.389 or 14 CFR 23.783 is the only required emergency exit for this class of aircraft as specified in CAR 3.387 or 14 CFR 23.807; i.e., on a single-engine aircraft with a seating capacity of five or less, no additional emergency exits are required. The Safety Board believes that additional emergency exits on small, single-engine aircraft are necessary and feasible, and in the case of the PA-28, could be easily provided. Discussions with Piper engineers have indicated that a rear window opposite the cabin door could readily be converted to an emergency exit window without airframe structural modifications. Windows on other aircraft models also could be readily converted to emergency exits without extensive alterations.

The Safety Board further believes that the airworthiness and operating regulations for general aviation aircraft specified in 14 CFR 23 and 14 CFR 91 should require exits to be easily operated with a single handle, be clearly marked as to their use, and be operable from outside the aircraft. The Board also believes that pilots should be encouraged to properly brief passengers on the emergency exits regardless of aircraft size or passenger capacity.

Small, single-engine aircraft represent a large portion of the general aviation fleet. Currently, there are over 19,000 active Cherokees in a fleet of over 198,000 single-engine aircraft. The Safety Board believes that an important increase in the level of protection offered to the general aviation flying public as a whole can be achieved by measures to improve egress from small, single-engine aircraft in an emergency.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend 14 CFR 23.783 to require that each external door on all aircraft manufactured after a specified date can be opened using only one handle or latching mechanism and that the means of operation be simple and apparent. (Class II, Priority Action) (A-81-26)
>
> Amend 14 CFR 23.807(a)(1) to require all aircraft with a seating capacity of two or more, excluding aircraft with canopies, manufactured after a specified date to have at least one emergency exit located on the opposite side of the cabin from the main door and to require that each emergency exit can be opened from both the inside and the outside of the aircraft. (Class II, Priority Action) (A-81-27)
>
> Amend 14 CFR 23.783, 14 CFR 23.807(b)(3), and 14 CFR Part 91 to require external doors and emergency exits of aircraft to be conspicuously marked on the outside with directions for opening the door. (Class II, Priority Action) (A-81-28)

KING, Chairman, DRIVER, Vice Chairman, and McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

US Department
of Transportation
**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave. S.W.
Washington, D.C. 20591

June 24, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to Safety Recommendation A-81-29 issued March 26, 1981. This recommendation resulted from the Board's investigation of instrument mounting clamp problems on Cessna aircraft.

A-81-29. Take action to notify all owners/operators of those Cessna model aircraft identified in Service Letter AV79-17 of the possible elevator control difficulties which can be encountered as a result of the Omni bearing indicator mounting clamp failure.

FAA Comment. The Federal Aviation Administration (FAA) is preparing an article for publication in the July issue of General Aviation Airworthiness Alerts (AC 43-16). This article is designed to alert maintenance persons to possible instrument clamp failure. FAA Malfunction or Defect records indicate that there have been seven clamp failures, all from Marion Screw Products, Inc. (MSP). Two of these failures were P/N 64311 clamps and five were P/N 9963 clamps. Rivets have been identified as the cause of these failures, and MSP has informed us that a change in the method of installing rivets on the clamps has been implemented.

All known clamp failures have occurred with Cessna airplanes. Cessna has informed us that three Service Information Letters (SIL) are being processed to advise customers of the need for an inspection and possible replacement of the MSP P/N 64311 and P/N 9963 clamps.

We believe that the issuance of AC 43-16, the corrective action taken by the clamp manufacturer, the Cessna's publication of SIL's satisfy the intent of Safety Recommendation A-81-29. Copies of these documents will be forwarded to the Board when published, and the FAA considers action completed on this recommendation.

Sincerely,

J. Lynn Helms
Administrator

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 26, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-29

On July 8, 1980, N36891, a Cessna 414A aircraft, was being operated on a Part 135 charter flight from Sacramento, California, to Fresno, California. About 15 minutes before landing at Fresno, the pilot attempted to press the radial centering knob on the Omni bearing indicator to establish a bearing to the station. However, when he pressed the knob, the instrument dropped partially inside the instrument panel and jammed the elevator control which restricted the aft movement of the elevator control to a position slightly aft of the neutral position. The aircraft was successfully landed at Fresno, California.

Investigation disclosed that the Marion Screw Products' mounting clamp, part number MSP9963, had loosened because one of the four rivets which maintains the clamp retaining capability was missing. When the condition was duplicated, it was found that with the loss of any rivet the instrument could be freed in its clamp and could create the difficulty experienced by the pilot.

Other instruments on the aircraft's instrument panel are mounted with the same type of clamp. Examination of two other clamps revealed a missing rivet from one and a loose rivet that could be moved by hand in the other.

A review of Service Difficulty Reports indicates that other Cessna 400 series aircraft have experienced this problem and, based on information received from the Federal Aviation Administration's Engineering and Manufacturing District Office in Wichita, Kansas, the problem could exist on other aircraft models.

The Cessna Aircraft Company is aware of the instrument mounting clamp problem; however, Cessna does not know whether the problem is caused by excessive torque being applied to the clamp adjusting screw or by a manufacturing defect. Cessna indicated that Service Letter AV79-17 which was issued on May 4, 1979, required the installation of a strap on the instrument mounting clamp to prevent the instrument from moving forward in the event of clamp failure. Service Letter AV79-17 was directed to certain Cessna series 300 and 400 aircraft where the Omni indicators were installed in the lowest position of the pilot's instrument panel, above or adjacent to the control column. Service Letter AV79-17 had not been complied with on the incident aircraft. Cessna also indicated that they plan to release another service letter on the instrument mounting clamps after its investigation is completed.

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Although the aircraft was landed successfully, the Safety Board is concerned that this potentially dangerous situation is likely to recur and could contribute to or cause an accident. Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Take action to notify all owners/operators of those Cessna model aircraft identified in Service Letter AV79-17 of the possible elevator control difficulties which can be encountered as a result of the Omni bearing indicator mounting clamp failure. (Class II, Priority Action) (A-81-29)

KING, Chairman, DRIVER, Vice Chairman, and McADAMS, GOLDMAN and BURSLEY, Members, concurred in this recommendation.

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

June 24, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-81-30 and A-81-31 issued March 26, 1981. These recommendations resulted from the Board's investigation of exhaust muffler problems on certain Piper aircraft models.

A-81-30. Amend Airworthiness Directive (AD) 68-05-01 to require that an inspection of the muffler and exhaust systems meeting the requirements of the AD be performed during the aircraft's annual inspection if a detailed inspection of the system has not been made during the preceding year on the basis of the time-in-service requirements of the AD.

A-81-31. Pending amendment of Airworthiness Directive (AD) 68-05-01, as an interim measure, issue an Airworthiness Alert to all owners/operators of Piper aircraft listed in the AD describing the circumstances of the failure of the muffler which caused this accident.

FAA Comment. The Federal Aviation Administration (FAA) fully agrees with the objectives of Safety Recommendations A-81-30 and A-81-31, but we do not believe that the regulatory action of amending AD 68-05-01 is the most effective method of accomplishing our objectives. These objectives are to increase the general aviation community's awareness of the safety hazards associated with a poorly maintained exhaust system on single engine airplanes and to provide constructive information and guidance on how to alleviate these hazards.

An amendment of AD 68-05-01 to require an annual inspection of the Piper tri-pacer exhaust system would be redundant to the existing annual inspection requirements of FAR 91.169,43 and paragraph d in Appendix D of FAR 43. Therefore, in lieu of amending AD-68-05-01 as recommended by the Board, we will develop an advisory circular (AC) that emphasizes the safety hazards of poorly maintained exhaust systems on single engine airplanes, provides information on the kinds of problems to be expected, and outlines specifics of an effective exhaust system annual inspection program.

This advisory circular will also provide pilots with guidance and information on the kinds of checks they can perform on the exhaust system during operation of the aircraft between required inspections.

We believe these actions are fully responsive to Safety Recommendations A-81-30 and 31, and a copy of the AC will be forwarded to the Board when published.

Sincerely,

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 26, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-30 and -31

On February 18, 1980, a Piper PA-22-150 Tri-Pacer aircraft crashed in a rural area near Clear Spring, Maryland. Witnesses observed the aircraft in erratic flight and saw it enter into a steep right bank before crashing into trees. The pilot died of acute carbon monoxide intoxication and multiple injuries.

The Safety Board's investigation of the accident did not disclose any evidence of a structural, control, or engine malfunction. However, two cracks were found in the exhaust muffler assembly, one of which was located along a welded seam. The seam crack allowed exhaust gases to impinge upon and stain the inner surface of the muffler shroud assembly and escape from the confines of the exhaust system. The path which the exhaust gas stain followed indicated that the crack was not impact-related. It was also evident that this crack was not recent, nor the result of the accident. The other crack was in one of the other exhaust stacks. The exhaust muffler cracks would have allowed escaping exhaust gas to enter the cabin through open air vents and cause the pilot to become incapacitated.

Airworthiness Directive (AD) 68-05-01, effective March 31, 1968, and revised March 5, 1969, requires that exhaust mufflers on certain Piper aircraft models with less than 950 hours time in service be inspected for cracks and other deficiencies at intervals not to exceed 100 hours until reaching 950 hours time in service. At and beyond 950 hours, the repetitive inspections are to be conducted at 50-hour intervals.

The accident aircraft's records indicated that the exhaust muffler assembly had been installed during June 1967, the muffler had been last inspected in accordance with the provisions of AD 68-05-01 during October 1971, and the aircraft had been operated for 269 hours between June 1967 and October 1971. The aircraft was operated an additional 159 hours between October 1971 and October 1979. The maintenance logs of the aircraft also indicated that its exhaust system had been "checked" during several annual inspections, including the last annual inspection conducted 10 hours before the accident; however, the exhaust system cracks were not detected.

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The Safety Board recognizes that the operator of the accident aircraft did not maintain the aircraft in accordance with AD 68-05-01. However, we believe that this accident points to a particular problem to which aircraft with low utilization rates are prone, and which is not addressed by the AD. Although the apparent intent of the AD is to insure routine detailed inspections of the exhaust systems, the requirement for a detailed inspection in aircraft with utilization rates as low as that of the accident aircraft could be triggered only once in 5 years. The muffler assembly had been in service for 13 years and had 438 hours of operation when the accident occurred.

AD 68-05-01 is based on hours of operation. However, corrosion (one of the key factors in muffler degradation) occurs continuously, even when the aircraft is not being operated. In fact, mufflers that are used only occasionally tend to corrode more rapidly than those with higher utilization rates. It does not appear that this fact was fully considered during the preparation of AD 68-05-01.

If the inspection requirements in AD 68-05-01 were extended to require also inspections at a prescribed calendar interval, such as during the aircraft's annual inspections, exhaust muffler assembly cracks would be more likely to be detected, particularly on aircraft with low utilization rates.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend Airworthiness Directive (AD) 68-05-01 to require that an inspection of the muffler and exhaust systems meeting the requirements of the AD be performed during the aircraft's annual inspection if a detailed inspection of the system has not been made during the preceding year on the basis of the time-in-service requirements of the AD. (Class II, Priority Action) (A-81-30)
>
> Pending amendment of Airworthiness Directive (AD) 68-05-01, as an interim measure, issue an Airworthiness Alert to all owners/operators of Piper aircraft listed in the AD describing the circumstances of the failure of the muffler which caused this accident. (Class II, Priority Action) (A-81-31)

KING, Chairman, DRIVER, Vice Chairman, and McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

US Department of Transportation

Federal Aviation Administration

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

June 24, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to Safety Recommendations A-81-32 and A-81-33, issued March 26, 1981. These recommendations resulted from the Board's investigation of the crash of an Avions Marcel Dassault Breguet Falcon 10, N253K, into Lake Michigan on January 30, 1980.

A-81-32. Issue an airworthiness directive to move the emergency/park brake light on all Falcon 10 aircraft from its present location to a location on the pilot's instrument panel where it can be monitored more readily by both pilots when seated normally in the cockpit.

FAA Comment. Federal Aviation Regulation (FAR) 25.735(d) requires that the airplane must have a parking control (brake) that, when set by the pilot, will, without further attention, prevent the aircraft from rolling on a paved level runway with takeoff power on the critical engine. The narrative accompanying this recommendation states that with the lever in the park position, the Falcon 10 can be set in motion with relative ease when thrust is applied for taxi. However, the Falcon 10 parking brake complies with the requirements of FAR 25.735(d) when set to the full park position. Even in the intermediate brake position, the aircraft is immobilized for N1 values up to 75 percent. The recommendation does not specify the power level used as a basis for the statement, ". . . that the aircraft can be set in motion with relative ease when power is applied for taxi . . . ." Moreover, we are unable to speculate on the condition of the parking brake, as it may relate to this statement. However, we have evaluated the regulatory requirement and find it to be appropriate, and we have also determined that the aircraft meets certification requirements.

In our view, Safety Recommendation A-81-33 is a more valid suggestion, and we believe our action relative to A-81-33 will be fully effective in correcting the deficiencies that contributed to this accident. Traditionally, parking brake warning lights have been located in a nonprominent position in other aircraft because of space limitations and this has posed no serious problem. Also, some aircraft have no emergency/park brake lights. For these reasons, we do not concur in the intent of this recommendation and the Federal Aviation Administration (FAA) plans to take no further action on Safety Recommendation A-81-32.

A-81-33. Review the checklists of all Falcon 10 operators to insure that they include checks that the parking brake is released and the emergency/park brake light is "out" before taxi and before takeoff.

FAA Comment. The FAA intends to issue an operations bulletin which will direct operations inspectors to review checklists used by Falcon 10 operators. The bulletin will require that a procedure for checking emergency/park brake handle position and associated warning light prior to takeoff be included in the checklist. A copy of this document will be forwarded to the Board and, with issuance, the FAA considers action completed on Safety Recommendation A-81-33.

Sincerely,

Helms

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 26, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-32 and -33

At 1548:35 c.s.t., on January 30, 1980, an Avions Marcel Dassault Breguet Falcon 10, N253K, crashed into Lake Michigan shortly after an attempted takeoff from runway 18 at Meigs Field, Chicago, Illinois. The aircraft came to rest in 25 feet of water about 300 feet from the departure end of the runway. Of the four passengers and two crewmembers aboard, one passenger and one crewmember were killed, and four persons were injured seriously. The aircraft was destroyed. The pilot stated that although the aircraft had accelerated to rotation speed during the takeoff roll, it did not lift off the runway when he rotated for flight, and he elected to continue the takeoff because there was insufficient runway remaining to stop the aircraft.

Although the Safety Board's investigation of the accident has not been completed, evidence indicates that certain precautionary actions should be initiated to prevent a similar occurrence. Metallurgical examination of the emergency/park brake lever and quadrant showed that the lever was in the "park" position during the takeoff roll. With this lever in the "park" position, the Falcon 10 can be set in motion with relative ease when thrust is applied for taxi. In order to prevent this occurrence, the manufacturer installed a red warning light on the lower right corner of the pilot's instrument panel which will illuminate when the lever is in either the "park" or the "emergency" position. However, the Safety Board is concerned about the location of this brake warning light. With both pilots seated normally, the light can be hidden partially from the pilot by his right knee and from the copilot by the emergency/park brake lever. Additionally, the light is not within the normal instrument scan area for either pilot. The Safety Board believes that this brake light should be moved to a position on the instrument panel where it can be monitored easily by both pilots under all internal and external light conditions.

Comparison of the manufacturer's suggested checklist for the Falcon 10 with the company checklist approved by the Federal Aviation Administration and used by the flightcrew of N253K indicated that the manufacturer's suggested checklist recommended that the status of the brake light be checked on three separate occasions before the start of the takeoff roll. However, none of the checks appeared on the company checklist. The Safety Board believes that, had these checks appeared on the checklist used by the flightcrew of N253K, the possibility of an attempted takeoff with the parking brake set would have decreased considerably.

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Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Issue an airworthiness directive to move the emergency/park brake light on all Falcon 10 aircraft from its present location to a location on the pilot's instrument panel where it can be monitored more readily by both pilots when seated normally in the cockpit. (Class II, Priority Action) (A-81-32)

Review the checklists of all Falcon 10 operators to insure that they include checks that the parking brake is released and the emergency/park brake light is "out" before taxi and before takeoff. (Class II, Priority Action) (A-81-33)

KING, Chairman, DRIVER, Vice Chairman, amd McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

U.S. Department
of Transportation

Federal Aviation Administration

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

June 26, 1981

The Honorable James B. King
Chairman, National Transportation
  Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-81-39 through A-81-42 issued by the Board on March 30, 1981. These recommendations resulted from the Board's investigation of the crash of a Beech B-99, N390CA, near Spokane, Washington, on January 20, 1981. The accident occurred while the pilot was attempting a localizer approach to runway 3 (LOC Rwy 3) at Spokane International Airport. The NTSB expressed a belief that the navigational aid configuration between the Spokane (GEG) facility and the localizer facility (IOLJ) constituted a hazard in this accident.

These recommendations were made prior to an NTSB hearing held in Spokane, Washington, in April 1981. The Federal Aviation Administration (FAA) was a party in this hearing. Based on testimony and facts presented during the hearing, review of the accident package, and data relating to this and similar procedures, the FAA finds no evidence that the localizer runway 3 procedure for Spokane International Airport, Spokane, Washington, was a factor in this accident. Our comments, therefore, are submitted based, in part, on these findings.

A-81-39. Publish a Notice to Airman pertaining to the localizer approach to runway 3 at Spokane International Airport, Spokane, Washington, emphasizing the need to use the IOLJ distance measuring equipment once established on the final approach course to runway 3.

A-81-40. Add a precautionary note in the plan view section of the chart for a localizer approach to runway 3 at Spokane International Airport, Spokane, Washington, such as:

CAUTION

Use 109.9 IOLJ DME (Channel 36)
For Final Approach Course
Distance Information

FAA Comment. We have reviewed the Spokane localizer procedure and find that the requirement to use the IOLJ distance measuring equipment (DME) when established on the final approach course to runway 3 is adequately reflected. Accordingly, we can find no justification for publishing a Notice to Airmen. In concert with this determination, we find no justification for adding a precautionary note relative to this procedure. Accordingly, the FAA intends to take no further action on Safety Recommendations A-81-39 and A-81-40.

A-81-41. Review all approach procedures and identify those airports that have a localizer or instrument landing system approach with distance measuring equipment facilities at two points along with the final approach course, leading to the possibility of erroneous tuning, and add a precautionary note on the pertinent approach chart.

FAA Comment. The FAA has completed a review of approach procedures where DME is installed at a localizer. Our evaluation of the procedures leads us to conclude that the chart portrayal is adequate. However, we share the Board's concern with respect to whether the best possible means of charting information on an approach plate is being used. Accordingly, the FAA has initiated an effort, in conjunction with the National Ocean Survey, to determine if we can improve on the existing method of depiction. Changes currently being considered include: addition of the letters "LOC" after the identification of the facility forming the fix, i.e., IOLJ LOC DME; and inclusion of a note in the profile view similar to that described in Safety Recommendation A-81-40. We will inform the Board of our finding when this effort is completed.

A-81-42. Alert pilots of the potential for error in making approaches at airports equipped with distance measuring equipment at two points along the final approach course through publication of appropriate precautionary information in the Airman's Information Manual.

FAA Comment. The FAA concurs in this recommendation and we are taking action to reemphasize the fact that multiple navigation aids may be required in the utilization of an instrument procedure. Concurrently, we intend to restate the importance of proper navigation aid selection, tuning, and identification. We will inform the Board when this action is completed.

Sincerely,

J. Lynn Helms
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 30, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-39 thru -42

On January 20, 1981, at 1127 p.s.t., a Beech B-99, N390CA, operated by Cascade Airways, Inc., as Flight 201, crashed about 4.5 miles southwest of Spokane International Airport, Spokane, Washington. The accident occurred while the pilot was attempting a localizer approach to runway 3 (LOC Rwy 3) at Spokane International Airport. The two pilots and five passengers died in the accident; two passengers survived with serious injuries. The aircraft was destroyed by impact and postcrash fire.

The Spokane VORTAC (115.5, GEG, Channel 102) was used for the inbound routing of Flight 210 and is used for the distance measuring equipment (DME) arc for a LOC Rwy 3 approach. Upon arrival in the Spokane area, the flight was vectored for an instrument landing system (ILS) approach to runway 21. However, before the flight began the approach to runway 21, the tower changed the active runway to runway 3 and vectored Flight 201 for the LOC Rwy 3 approach. This approach utilizes the IOLJ localizer (109.9) and collocated DME (Channel 36), both of which are located on the airport.

While Flight 201 was initially being vectored for the LOC Rwy 3 approach, the IOLJ localizer and its associated DME were not operational because the Rwy 21 ILS was still being used by other arriving aircraft. An interlock switch in the tower prevents simultaneous operation of these two facilities. The IOLJ localizer/DME were turned on about 1124:08. About this same time, Flight 201 was advised that the aircraft was "6 miles from OLAKE intersection, cleared for the approach." Shortly thereafter, Flight 201 was advised to contact the tower and Flight 201 acknowledged. No other calls were received from the aircraft.

The normal procedure for the LOC Rwy 3 approach allows descent to minimum descent altitude (MDA) (2,760 ft) after passing OLAKE intersection, which is 4.2 miles from IOLJ. Without the airport environment in sight, a missed approach would be executed at 0.2 DME before reaching IOLJ. Although the investigation of the Cascade Airways accident is continuing, one theory being examined is that Flight 201 may have mistakenly initiated an approach and let down prematurely using DME mileage from the

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Spokane (GEG) facility rather than the mileage from the localizer facility depicted on the LOC Rwy 3 approach chart. Investigators conducting the Safety Board's continuing investigation have interviewed five pilots, including airline and military crews, who have mistakenly commenced the LOC Rwy 3 approach using distance information from the Spokane DME instead of the IOLJ DME. If an approach was continued using the wrong DME (Spokane VORTAC), the aircraft would descend prematurely to MDA and could strike the terrain near the Spokane VORTAC, which is at approximately the same elevation as MDA. Flight 201's initial impact point was about 1,300 ft south-southeast of the Spokane VORTAC.

The Safety Board is aware that similar approach configurations exist at other airports throughout the United States where there are two DME facilities located near the localizer course, increasing the possibility that a tuning error could result in improper descent to terrain. Incident reports have been received from the NASA-sponsored Aviation Safety Reporting System Office describing similar occurrences where confusion existed at other airports with respect to proper distances from approach navigational aids.

The Safety Board has learned that the United States Air Force is considering the addition of a precautionary note in its instrument training manual (AFM 51-37) as well as publishing an All Command Safety Communication (ALSAFCOM) alerting pilots to the hazard of transition to an approach using one DME while another DME is associated with the final approach course.

The Safety Board believes this type of navigational aid configuration constitutes a hazard that must be corrected immediately. Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Publish a Notice to Airman pertaining to the localizer approach to runway 3 at Spokane International Airport, Spokane, Washington, emphasizing the need to use the IOLJ distance measuring equipment once established on the final approach course to runway 3. (Class I, Urgent Action) (A-81-39)
>
> Add a precautionary note in the plan view section of the chart for a localizer approach to runway 3 at Spokane International Airport, Spokane, Washington, such as:
>
> CAUTION
>
> Use 109.9 IOLJ DME (Channel 36)
> For Final Approach Course
> Distance Information
> (Class 1, Urgent Action) (A-81-40)
>
> Review all approach procedures and identify those airports that have a localizer or instrument landing system approach with distance measuring equipment facilities at two points along the final approach course, leading to the possibility of erroneous tuning, and add a precautionary note on the pertinent approach chart. (Class II, Priority Action) (A-81-41)

Alert pilots of the potential for error in making approaches at airports equipped with distance measuring equipment at two points along the final approach course through publication of appropriate precautionary information in the Airman's *Information* Manual. (Class II, Priority Action) (A-81-42)

KING, Chairman, DRIVER, Vice Chairman, and McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

NEW RECOMMENDATIONS

Following is a listing of the 35 new recommendations received during the second quarter of 1981:

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NEW RECOMMENDATIONS
(continued)

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 2, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20594

SAFETY RECOMMENDATION(S)

A-81-35

On the night of September 12, 1980, a Douglas DC-3, owned and operated by Florida Commuter Airlines, crashed and sank in approximately 1,800 feet of water near West End Settlement, Grand Bahama Island. All 4 crewmembers and 30 passengers were killed.

The Safety Board's investigation of the accident has revealed that the aircraft was being operated in an area of forecast thunderstorm activity although it was not equipped with, nor was it required to have, an airborne weather detection device.[1] This accident again focused our attention on the fact that the Douglas DC-3 is exempt from airborne weather detection device requirements of 14 CFR 121.357, 14 CFR 135.173, and 14 CFR 135.175 because it was certificated before the enactment of the Transport Category Rules. The Safety Board believes that this apparent regulatory gap contributed to an obviously unsafe flight operation. Thunderstorms and other forms of severe weather activity can be detected by airborne weather detection devices, thus warning the flightcrew of a potentially unsafe flightpath. The evidence indicates that thunderstorms were in the area where the aircraft was last reported.

The Safety Board is aware of and supports the independent review being conducted by the Federal Aviation Administration (FAA) and the Bahama Government of equipment requirements for large aircraft (as defined by 14 CFR Part 1) certificated before the enactment of Transport Category Rules.

The Safety Board believes that an airborne weather detection device is an essential system for the safe and efficient operation of all aircraft and therefore urges the Federal Aviation Administration to require all multiengine small aircraft having a passenger seating configuration, excluding any pilot seat, of more than 10 seats and all large aircraft which are engaged in passenger carrying operations to have an airborne weather detection device in satisfactory operating condition on board when hazardous

1/ As used herein airborne weather detection device includes airborne thunderstorm detection equipment (14 CFR 135.173) and airborne weather radar equipment (14 CFR 121.357 and 14 CFR 135.175).

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weather conditions may be expected along the route to be flown. Such equipment is currently required only for large transport category aircraft and for small multiengine aircraft having passenger seating configurations (excluding any pilot seat) of 10 or more seats.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Require all aircraft used in revenue passenger operations which are not presently required to be equipped with an approved weather detection device under 14 CFR 121 or 14 CFR 135 to have an appropriate airborne weather detection device that is in satisfactory operating condition when flight under IFR or night VFR conditions is anticipated and current weather reports indicate that thunderstorms or other potentially hazardous weather conditions that can be detected with an airborne weather detection device may reasonably be expected along the route to be flown. (Class II, Priority Action) (A-81-35).

KING, Chairman, DRIVER, Vice Chairman, and McADAMS and BURSLEY, Members concurred in this recommendation. GOLDMAN, Member, did not participate.

James B. King

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 2, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-36 through -38

On November 26, 1980, a Piper Model PA-20, N7453K, crashed approximately 3 miles southwest of East Berlin, Pennsylvania, after the right wing separated in flight due to metal fatigue failure of the lower front lift strut fork. All three persons aboard were killed.

In Safety Recommendation A-80-26, issued on April 9, 1980, the Safety Board directed the Federal Aviation Administration's (FAA) attention to several similar fatal accidents involving Piper aircraft. As a result, the FAA issued two emergency airworthiness directives (AD) dated April 17, 1980, and April 25, 1980, and AD 80-22-15 dated October 29, 1980, warning of potential fork fatigue cracking and failures. These directives required the replacement of machine (cut)-thread forks with forks having rolled threads within the next 50 hours or 180 days, whichever occurred first, and periodic dye penetrant and/or magnetic particle inspections of the forks. Maintenance records indicate that the accident aircraft, N7453K, had been inspected in accordance with the April 25, 1980, directive and that the forks had been inspected magnetically.

A review of AD 80-22-15 indicates that the directive is confusing and difficult to comply with and that it makes no reference to the previous emergency directives (which were effective upon receipt). Although AD 80-22-15 contains fork replacement requirements identical to those contained in the emergency directives (i.e., within the next 50 hours in service or 180 days), it has an effective date of November 3, 1980. However, discussion with FAA Eastern Region personnel indicated that the requirement for the 50-hour/180-day inspection period and the requirement for replacing with rolled-thread forks was intended to have been effective upon receipt of the first emergency directive issued on April 17, 1980.

Neither emergency directive was indexed in the FAA's biweekly listing. Therefore, unless the owner/operator recipients of the emergency directive advised them, maintenance personnel would not have been routinely aware of any potential lift strut fork fatigue problems before October 29, 1980, when AD 80-22-15 was issued. As a result, some affected aircraft given annual inspections between April 17, 1980, and October 29, 1980, were inadvertently certified as airworthy without complying with the emergency directives.

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AD 80-22-15 requires that maintenance personnel distinguish between lift strut forks with machined threads and those with rolled threads. However, there is no advice, method, or procedure contained in the AD (such as reference to appropriate magnification, thread gauge, etc.) to assist them in doing so. The mechanic who inspected the fork which failed in the accident aircraft incorrectly identified rolled threads as being machined threads. Comments from other mechanics indicated that they are experiencing similar difficulties in distinguishing rolled threads and machined threads. Therefore, the Safety Board believes that forks with rolled threads should have a part number different from those of forks with machined threads to simplify identification and to avoid the identification problem in future inspections.

The airframe maintenance log for the accident aircraft indicated that the lift strut forks had been inspected by magnetic means in June 1980. Examination of the failed fork, however, revealed extensive fatigue cracking across the face of the fracture and in several other thread root sections of the fork as well. It is unlikely that this fatigue developed in the interim between the June inspection and the accident. Rather, it appears that it was simply not detected during the required magnetic inspection performed in the field. Other similar field inspections have indicated cracked forks where no cracks actually existed. Because of the physical characteristics of the fork threads, considerable experience and expertise may be required in interpreting the results of the magnetic particle inspection. Therefore, the Safety Board believes that performance of the inspection should be limited to designated central facilities such as the manufacturer's plant, where fork inspection, metallurgy, and quality control can be closely monitored by specialists.

The Safety Board concludes that AD 80-22-15 and the preceding emergency directives have not been effective in assuring the continued airworthiness of these lift strut forks and that any effort to amend the AD would further complicate an already confused situation. The Safety Board believes that a new AD is needed to resolve the doubt which exists regarding the condition of all lift strut forks currently installed, including those with rolled threads. Consequently, the superseding AD should require the replacement of all existing lift strut forks with new forks unless such replacement has already been accomplished in compliance with AD 80-22-15. The periodic fork inspection and replacement intervals specified in AD 80-22-15 appear adequate and should be retained in the new AD.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an airworthiness directive superseding AD 80-22-15 to require that all lift strut forks currently installed on affected Piper aircraft, including forks with rolled threads, be replaced with new, certified, magnetically inspected forks. (This requirement need not apply in cases where such new forks have already been installed in accordance with AD 80-22-15.) (Class II, Priority Action) (A-81-36)
>
> Require manufacturers of rolled thread lift strut forks to be installed on Piper aircraft to identify them with a part number different from that of forks with machined threads. (Class II, Priority Action) (A-81-37)

Specify that required inspections of lift strut forks on Piper aircraft (enumerated in AD 80-22-15) be performed only by manufacturers authorized to fabricate these forks or by other designated central inspection facilities having the requisite facilities and expertise. (Class II, Priority Action) (A-81-38)

KING, Chairman, DRIVER, Vice Chairman, and McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 30, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-39 thru -42

On January 20, 1981, at 1127 p.s.t., a Beech B-99, N390CA, operated by Cascade Airways, Inc., as Flight 201, crashed about 4.5 miles southwest of Spokane International Airport, Spokane, Washington. The accident occurred while the pilot was attempting a localizer approach to runway 3 (LOC Rwy 3) at Spokane International Airport. The two pilots and five passengers died in the accident; two passengers survived with serious injuries. The aircraft was destroyed by impact and postcrash fire.

The Spokane VORTAC (115.5, GEG, Channel 102) was used for the inbound routing of Flight 210 and is used for the distance measuring equipment (DME) arc for a LOC Rwy 3 approach. Upon arrival in the Spokane area, the flight was vectored for an instrument landing system (ILS) approach to runway 21. However, before the flight began the approach to runway 21, the tower changed the active runway to runway 3 and vectored Flight 201 for the LOC Rwy 3 approach. This approach utilizes the IOLJ localizer (109.9) and collocated DME (Channel 36), both of which are located on the airport.

While Flight 201 was initially being vectored for the LOC Rwy 3 approach, the IOLJ localizer and its associated DME were not operational because the Rwy 21 ILS was still being used by other arriving aircraft. An interlock switch in the tower prevents simultaneous operation of these two facilities. The IOLJ localizer/DME were turned on about 1124:08. About this same time, Flight 201 was advised that the aircraft was "6 miles from OLAKE intersection, cleared for the approach." Shortly thereafter, Flight 201 was advised to contact the tower and Flight 201 acknowledged. No other calls were received from the aircraft.

The normal procedure for the LOC Rwy 3 approach allows descent to minimum descent altitude (MDA) (2,760 ft) after passing OLAKE intersection, which is 4.2 miles from IOLJ. Without the airport environment in sight, a missed approach would be executed at 0.2 DME before reaching IOLJ. Although the investigation of the Cascade Airways accident is continuing, one theory being examined is that Flight 201 may have mistakenly initiated an approach and let down prematurely using DME mileage from the

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Spokane (GEG) facility rather than the mileage from the localizer facility depicted on the LOC Rwy 3 approach chart. Investigators conducting the Safety Board's continuing investigation have interviewed five pilots, including airline and military crews, who have mistakenly commenced the LOC Rwy 3 approach using distance information from the Spokane DME instead of the IOLJ DME. If an approach was continued using the wrong DME (Spokane VORTAC), the aircraft would descend prematurely to MDA and could strike the terrain near the Spokane VORTAC, which is at approximately the same elevation as MDA. Flight 201's initial impact point was about 1,300 ft south-southeast of the Spokane VORTAC.

The Safety Board is aware that similar approach configurations exist at other airports throughout the United States where there are two DME facilities located near the localizer course, increasing the possibility that a tuning error could result in improper descent to terrain. Incident reports have been received from the NASA-sponsored Aviation Safety Reporting System Office describing similar occurrences where confusion existed at other airports with respect to proper distances from approach navigational aids.

The Safety Board has learned that the United States Air Force is considering the addition of a precautionary note in its instrument training manual (AFM 51-37) as well as publishing an All Command Safety Communication (ALSAFCOM) alerting pilots to the hazard of transition to an approach using one DME while another DME is associated with the final approach course.

The Safety Board believes this type of navigational aid configuration constitutes a hazard that must be corrected immediately. Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Publish a Notice to Airman pertaining to the localizer approach to runway 3 at Spokane International Airport, Spokane, Washington, emphasizing the need to use the IOLJ distance measuring equipment once established on the final approach course to runway 3. (Class I, Urgent Action) (A-81-39)

> Add a precautionary note in the plan view section of the chart for a localizer approach to runway 3 at Spokane International Airport, Spokane, Washington, such as:

<u>CAUTION</u>

Use 109.9 IOLJ DME (Channel 36)
For Final Approach Course
Distance Information
(Class 1, Urgent Action) (A-81-40)

> Review all approach procedures and identify those airports that have a localizer or instrument landing system approach with distance measuring equipment facilities at two points along the final approach course, leading to the possibility of erroneous tuning, and add a precautionary note on the pertinent approach chart. (Class II, Priority Action) (A-81-41)

Alert pilots of the potential for error in making approaches at airports equipped with distance measuring equipment at two points along the final approach course through publication of appropriate precautionary information in the Airman's Information Manual. (Class II, Priority Action) (A-81-42)

KING, Chairman, DRIVER, Vice Chairman, and McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 13, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator-Designate
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-43

On November 17, 1980, Air Miami Air Taxi Flight 421, a deHavilland DH-114, operating for Air Florida, was being vectored at a point about 30 miles southeast of Fort Myers, Florida, when it encountered an area of light to moderate turbulence. The aircraft experienced "a moderate updraft followed by a severe downdraft" and continued to descend at a high rate with heavy buffeting. At the time, the copilot noticed a section of the right wing leading edge between the No. 3 and the No. 4 engine nacelles was missing. Rather than continue to his destination, the pilot elected to land at Immokalee Airport located about 3 miles away. The pilot landed the aircraft successfully without injuring any of the 3 crewmembers or the 13 passengers aboard.

Investigation revealed that the latch fastener arm on the right wing outboard leading edge inspection door moved out of position and the door opened upward into the slip stream, causing a "spoiler" type reaction and partial loss of aircraft control. A major portion of the door's upper structure also separated from the aircraft. The latching mechanism failure was probably caused by a combination of factors, such as flexing of the wing, air flow, or wear.

Prinair of Puerto Rico, operator of a fleet of 25 deHavilland DH-114 aircraft, and Caribbean Aircraft Development, Inc., (CADI), an overhaul facility for the DH-114 aircraft, has advised the Safety Board that a number of similar incidents have occurred and that partial loss of aircraft control had been experienced in each instance. CADI adopted a method of securing each inboard and outboard wing leading edge inspection door latch fastener arm and latch crossbar in the closed and locked position by using MS 9226-05 safety wire. Prinair has prepared and issued Engineering Order 923-1 covering this modification for the internal use of Prinair and CADI.

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In view of the above, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an airworthiness directive to require that all deHavilland DH-114 aircraft wing leading edge inspection door latching mechanisms be secured in the closed and locked position in accordance with Prinair's Engineering Order 923-1. (Class II, Priority Action) (A-81-43)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 16, 1981

Forwarded to:

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-44 and -45

The National Transportation Safety Board's investigation of the crash of a Bellanca 8 KCAB Decathlon aircraft in Queenstown, Maryland, on March 7, 1979, has revealed a hazardous condition which could affect the safety of flight of similarly equipped aircraft when performing aerobatic maneuvers. The pilot of the accident aircraft was practicing for his flight demonstration to obtain an "unlimited letter of competence" permitting aerobatics at and above ground level (AGL) when the aircraft crashed. He already held a "letter of competence" permitting him to perform aerobatics at and above an altitude of 200 feet AGL.

The investigation failed to disclose an aircraft mechanical malfunction, and postmortem examination of the pilot revealed no preexisting diseases. However, the aircraft's previous owner stated that during full forward stick aerobatic maneuvers the rear control stick had become entangled on occasion in the front-seat acrobatic shoulder harness where it was routed up the back of the front seat. He said that freeing the control stick was accomplished by releasing the front-seat narrow webbing lapbelt, thus releasing the shoulder harness. Additionally, a student of the fatally injured pilot said that earlier in the week the front-seat narrow webbing lapbelt had been slipping and had to be retightened between maneuvers.

The front seat of the accident aircraft, which was manufactured in 1972, was equipped with a dual-restraint system designed to provide restraint for normal and aerobatic flight. The front-seat restraint system consisted of a lapbelt of narrow webbing with a fabric-to-metal friction buckle. The lapbelt was attached to the seatframe at the seatback-to-seatpan intersection. The seat also was equipped with a narrow webbing, dual-strap shoulder harness which slipped over the lapbelt webbing. Each shoulder harness strap was modified from the original installation to attach to the seatframe at the same points as the lapbelt. The shoulder harness was routed up the back of the seat and through fabric shoulder harness guides at the top of the seatback. An additional lapbelt of wider webbing, equipped with a metal-to-metal buckle, was attached to the floor. Bellanca has indicated that the restraint systems described above were standard equipment for that model year. However, the shoulder harness straps were designed to attach at a single point to the overhead wing carry-through

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structure rather than to the seat where they must be routed up the back of the seat. Later models of the Decathlon employ a lapbelt and single diagonal shoulder harness as the primary restraint system and a five-point acrobatic restraint system with the shoulder harness installed in front of the seatback and the inertia reel attached to the seatpan frame.

Thus, a potentially dangerous situation is created when the attach points of the acrobatic shoulder harness are altered on aircraft manufactured prior to 1973, such as was done in the accident aircraft, and/or when the shoulder harness straps are routed behind the front seatback. In fact, the propensity for owners to reroute the shoulder straps creating this hazard to aerobatic flight apparently was recognized by the Bellanca Aircraft Company. In May 1977, the company changed the FAA-approved Decathlon flight manual by adding a new section, "Occupant Restraint Systems," which contains the following caution: "DO NOT ALLOW SHOULDER HARNESS TO RUN UP BEHIND THE FRONT SEAT BACK WHERE IT MAY POSSIBLY INTERFERE WITH REAR STICK MOVEMENT." This section also notes that the acrobatic restraint system does not provide crash protection and therefore should always be used with the primary lapbelt and shoulder harness. This information should be particularly useful to owners of Decathlon aircraft built between 1973 and 1977 who presently may be unaware of the potential hazard.

The Safety Board believes that a modified acrobatic restraint system which permits the acrobatic shoulder harness straps to run up the back of the front seat as described above presents a potential hazard in aerobatic flight since this modification apparently can result in entanglement of the rear control stick with the front-seat shoulder harness.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Immediately issue a General Aviation Airworthiness Alert warning Decathlon owners of the potential hazards to aerobatic flight when they modify Decathlon acrobatic restraint systems by attaching the shoulder harness to the seatpan frame and/or route the shoulder straps behind the seatback. (Class I, Urgent Action) (A-81-44)
>
> Issue an Airworthiness Directive revising the Bellanca Decathlon FAA-approved flight manual for aircraft manufactured prior to 1977 to include the relevant cautionary information of section 2.1.9, "Occupant Restraint Systems," which is contained in subsequent approved flight manuals. An accurate description of the proper installation of the restraint systems should be included. (Class II, Priority Action) (A-81-45)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

James B. King

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 16, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator-Designate
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-46 and -47

On May 9, 1980, a Bell 206B helicopter, N90095, rolled rapidly to the right and crashed into the Gulf of Mexico during an attempted vertical takeoff from an offshore oil rig helipad. The pilot was killed; the two passengers were not injured. The Safety Board's investigation revealed that the right main landing skid had been momentarily snagged on the edge of a trap door located on the helipad. The abrupt right roll apparently was caused by the snag, and the pilot was unable to take corrective action to regain control because of the dynamic rollover characteristics of single rotor helicopters.

Dynamic rollover was initially identified during military helicopter operations involving sideslope landings and takeoffs. If a pilot is not attentive to roll attitude during the maneuver, a rolling moment can develop about a landing skid in contact with the slope. If the roll angle reaches a critical value, application of full opposite lateral cyclic will not be sufficient to prevent the helicopter from rolling over on its side. As a result of numerous occurrences of this type, the military safety organizations prepared and distributed information concerning the causes of this phenomenon and the corrective actions to be taken should dynamic rollover conditions be encountered; appropriate warning notices and the critical slope angles for individual helicopter models were also added to the flight manuals. As a result of these actions, the number of military helicopter accidents involving dynamic rollover has been reduced significantly.

A review and evaluation of civil rotorcraft accidents from 1974 through 1978 indicate that about 20 percent of the 101 rollovers listed had conditions present which could have resulted in dynamic rollover. The Safety Board is concerned that the civil helicopter community has not been adequately warned about conditions which can lead to this phenomenon. As was evident in this accident, a takeoff from a sideslope is not a prerequisite for dynamic rollover. Any condition which causes the helicopter's attitude to reach its critical roll angle with one skid in contact with the ground before the pilot recognizes the problem can lead to this type of rollover accident.

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Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Require single rotor helicopter manufacturers to analyze and define the critical slope angles of each model and include this information in the individual flight manuals. (Class II, Priority Action) (A-81-46)
>
> Include detailed discussions on helicopter dynamic rollover characteristics and corrective actions to be taken in: (1) the Basic Helicopter Handbook, (2) written examinations, (3) helicopter flightcheck oral examinations, and (4) any other publication deemed appropriate for the dissemination of safety of flight information. (Class II, Priority Action) (A-81-47)

KING, Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations. DRIVER, Vice Chairman, did not participate.

James B. King

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 5, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-48

On May 7, 1980, during a practice aerobatic flight, an Aerotek Pitts Special S2S crashed near Olathe, Kansas. Even though this investigation is still in process, the National Transportation Safety Board has reason to believe that the pilot may have experienced physiological incapacitation as a result of G forces encountered while performing aerobatic maneuvers.

The pilot had completed his "known" sequence of 18 maneuvers. At the suggestion of an observer, a regional aerobatic judge who was critiquing his maneuvers, the pilot decided to fly his "free" sequence, a series of 25 maneuvers. After a short rest, the pilot began these maneuvers which he had flown many times. He had completed maneuver number 19, two and one-half rolls from inverted to upright, which was preceded by an outside three-quarter loop. After completing the roll maneuver, the aircraft flew straight and level for a short time. The aircraft then started a short climb, then the nose dropped below the horizon and the aircraft departed the practice box in a 45° nosedown attitude. The aircraft impacted in a heavily wooded area and burned. The pilot did not survive.

During the entire practice flight, the pilot had been in radio contact with the observer on the ground. When the pilot appeared to break off his series of maneuvers and depart the practice box, he was asked his reasons for this but he did not reply. The investigation has not revealed any preimpact aircraft malfunctions; postmortem examination of the pilot disclosed no diseases.

The effect of aerobatic G forces, i.e., Gz or vertical axis forces, on human physiology is well stated in a Federal Aviation Administration (FAA) publication entitled "G Effects on the Pilot During Aerobatics," FAA-AM-72-28, July 1972, by Stanley R. Mohler, M.D. This report provides information relative to the nature of aerobatic G forces; human physiology in relation to G forces; human tolerances and exposure limits to G forces; and methods to increase tolerance to aerobatic G forces. Data in the report indicates that aerobatic pilots can expect to experience a variety of symptoms resulting from different levels of positive and negative G's over a wide

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range of exposure times. Symptoms from gray-out to unconsciousness can occur during a positive G maneuver (referred to as an "inside" maneuver). A negative G maneuver (referred to as an "outside" maneuver) can result in discomfort, headaches, or unconsciousness. For the aerobatic pilot, the most significant finding in the report is the fact that loss of consciousness most likely will occur when high negative G maneuvers are followed by high positive G maneuvers such as a vertical "8" (i.e., an outside upper loop followed by an inside lower loop). Unconsciousness occurs due to the rapid swing from negative to positive G forces resulting in decreased blood circulation to the brain at G force levels of -3.5 to -4, and +4 to +4.5.

G forces sustained in aerobatic demonstrations and competitions today are more likely to be near -6.5 and +8 G's for some aerobatic aircraft. The pilot's last two maneuvers, mentioned previously, took him from a high negative G in the pullout from an outside loop into a sustained high positive G environment of two and one-half rolls. It is the Safety Board's opinion that, in the light of the evidence presented, physiological incapacitation of the pilot can not be ruled out.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Include in a future revision of the Airman Information Manual (AIM), Basic Flight Information and ATC Procedures, Chapter 7, Medical Facts for Pilots, a brief discussion of the physiology of aerobatic G forces as explained in FAA-AM-72-28. (Class II, Priority Action) (A-81-48)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

James B. King

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 7, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-49 through -53

For the past several years, the Beech Baron/Travel Air series of airplanes have demonstrated a propensity for entering flat spins under conditions of high asymmetric power and low speed. Between March 1978 and March 1980, there were eight fatal accidents of this type. The accident at Cumming, Georgia, on February 19, 1980, involving a Beech 95-B55 typifies the operational circumstances of most of these accidents. The instructional flight was the second in a multiengine course involving single-engine operation and the demonstration of minimum control speed. The pilot trainee, the only survivor, recalls attempting to move his body as far forward as possible during the spin in order to bring the nose of the airplane down. Witnesses saw the aircraft spinning with the tail lower than the nose.

The involvement of Beech Baron/Travel Air airplanes in flat spin accidents is not a new problem nor one that has just recently emerged. The Safety Board has previously sent five safety recommendations (A-75-64 and A-76-97 through -100) to the Federal Aviation Administration (FAA) regarding this subject. The Safety Board believes that had the FAA complied with these recommendations some of these accidents may have been prevented.

Based on the circumstances of these accidents, the Safety Board concludes that training for a potential emergency in Beech Baron/Travel Air airplanes, such as an engine-out condition, may be more hazardous than the emergency itself. For some conditions of airplane gross weight and altitude, the single-engine stall speeds of the aircraft are greater than the single-engine minimum control speeds (Vmc). Consequently, when pilots, including instructor pilots, attempt to demonstrate Vmc or loss of directional control, they may unexpectedly encounter a single-engine stall. At high asymmetric power, the stall in these airplanes is abrupt and is accompanied by rapid rolling to an inverted or near inverted position, followed by entry into a flat spin.

While one could take the position that pilots should be more careful and recover the airplane before this loss-of-control situation develops, the Safety Board believes that such a position is tenuous. The Beech Baron flat-spin accident record, coupled with the fact that some of the instructor pilots involved were highly experienced in Beech aircraft, tends to confirm that the situation demands above-average pilot skill and alertness.

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The single-engine stall characteristics of these aircraft, under the above circumstances, create an undue tendency to spin that is not measured or tested under 14 CFR 23.205, "Critical Engine Inoperative Stalls." Tests under this part, for example, involve: (1) only 75 percent maximum continuous power, or less, rather than takeoff or maximum available power used in Vmc demonstrations; (2) a feathered propeller rather than a windmilling propeller; and (3) minimal sideslip. This regulation, when scrutinized, is relatively weak insofar as detection of undue spinning tendencies is concerned.

In any event, the airplane is not safely controllable or maneuverable under the high asymmetric power conditions and other adverse factors that are routinely related to the demonstration of Vmc. With high asymmetric power, rolloff at the stall constitutes an unsafe feature that is not compatible with intended usage in a multiengine training environment.

The U.S. Army in a 1974 report, "T-42A Single-Engine Performance and Stall Investigation," described the single-engine (asymmetric) power on stalls of the Beech Model B55B as violent and potentially catastrophic. The following excerpts from that report detail these characteristics:

> The stall characteristics with single-engine power on are considerably more severe than those for symmetrical power conditions. Single-engine power-on stall is characterized by a rapid roll toward the inoperative (dead) engine. If not immediately arrested, this roll progresses rapidly into a wing-over or split-S entry into an upright spin. Vigorous and immediate recovery action is required.
>
> <u>Instantaneous Recovery Action.</u> When recovery was initiated immediately at stall, a rapid forward movement of the elevator control normally arrested the roll rate and regained control of the aircraft. Full rudder control opposite to the direction of roll was normally already applied since stall occurs below Vmc. If full rudder had not been previously initiated, it was applied concurrently with the forward elevator control. If these combined actions did not arrest the roll rate, power was reduced on the operative (good) engine. Recovery was normally from a large bank angle (approaching 90 degrees), nose-down attitude which results in a steep, diving pullout. Rapidly increasing airspeed during the pullout exceeded the airframe limits for the landing gear and flaps requiring these items to be retracted. Extreme care was necessary during the pullout to avoid a high-speed, accelerated stall.
>
> <u>Delay Recovery Action (1 second delay).</u> When any delay in recovery action was allowed at full stall, the roll rate increased rapidly. Virtually full forward movement of the elevator control and complete power reduction on the operative engine was required for recovery. Recovery following a slight delay (1/4 to 1/2 second) was from a split-S or complete wing-over maneuver. With slightly longer delays (approaching 1 second) the wing-over progresses immediately into an upright spin. The considerations discussed above concerning rapidly building airspeed and avoidance of a high-speed, accelerated stall likewise apply for the delayed recovery.

In 1976, the operational concept of a safe single-engine speed (Vsse) was introduced to alleviate the adverse dynamic effects of an intentional engine-out at or close to either Vmc or the single-engine stall speed. Subsequently, the FAA disseminated information regarding Vsse and proper engine inoperative procedures through flight training clinics, pilot safety seminars, and flight instructor refresher courses. Any beneficial effects, however, were short-lived as evidenced by the increasing number of Beech Baron flat-spin accidents. The Safety Board believes that, in addition to pilot education, positive effort is needed to resolve any existing undue spinning tendencies during critical engine-inoperative stalls of this as well as similar aircraft which may be certificated in the future.

In October 1980, the Beech Aircraft Corporation initiated a stall research program to study the potential for moderating the inherent roll rates of conventional light twin-engine aircraft in single-engine, fully stalled conditions. Beech anticipates that this two-phase wind tunnel/flight test program will take at least 18 months to complete. While Beech's stall research program is commendable, the Safety Board does not believe that it is adequately expedient in resolving the involvement of Beech airplanes in flat-spin accidents.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Require that a placard be installed in all Beech Baron/Travel Air aircraft warning of the dangers of and prohibiting intentional single-engine stalls. (Class II, Priority Action) (A-81-49)
>
> Amend 14 CFR 23.205, "Critical Engine Inoperative Stalls," to make the test requirements more rigorous with regard to the potential detection of an airplane's propensity to display any undue spinning tendency. (Class II, Priority Action) (A-81-50)
>
> Require Beech Aircraft Corporation to disseminate information relating to Beech Baron/Travel Air single-engine stall speeds, including graphical or other information showing the operational conditions and limits wherein flight at the published value of Vmc is not possible. (Class II, Priority Action) (A-81-51)
>
> Convene a special certification review team to explore and evaluate the relative margins of safety of the Beech Baron in low-speed, high-power, single-engine operations for all conditions which may be realistically anticipated in a multiengine, pilot-training environment. (Class II, Priority Action) (A-81-52)
>
> Require that all Beech Baron/Travel Air aircraft be retrofitted with aerodynamic air flow kits or components designed to alleviate their hazardous single-engine stall characteristics. Relative to the retrofit, Beech Aircraft's stall research program should provide for prompt development of appropriate hardware, rigging of controls, and/or other necessary modifications. (Class II, Priority Action) (A-81-53)

In addition, the National Transportation Safety Board reiterates our previous recommendation that the Federal Aviation Administration:

Issue an Advisory Circular dealing solely with simulated and actual engine-out emergencies in typical high performance, multiengine general aviation airplanes. (Class II - Priority Action) (A-75-64)

This Circular, aside from providing general operational guidelines and technical information, should supplement present FAA Advisory Circular 61-67, "Hazards Associated With Spins in Airplanes Prohibited From Intentional Spinning," by placing special emphasis on the potentially catastrophic and often irreversible situations which may develop, such as the flat spin, if a loss of control is allowed to occur. This information should be mailed directly to all pilots holding multiengine class ratings, distributed to fixed base operators and flight schools, and disseminated among the various flight instructor clinics and safety seminars held throughout the year. In addition, the FAA's Accident Prevention Staff should, where feasible, discuss operational details with recipients to assure that the objectives of the Circular are thoroughly understood.

KING, Chairman, DRIVER, Vice Chairman, McADAMS and GOLDMAN, Members, concurred in these recommendations. BURSLEY, Member, did not participate.

James B King

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 8, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

A-81-54 through -56

The Flight Standards National Field Office, AFO-500, Service Difficulty Automatic Data Processing System Bank has provided statistical information which indicates that there is an upward trend in Service Difficulty Reports concerning the Brackett engine air inlet systems.

In October 1980, engine air inlet system problems in the Cessna 177 alerted the Federal Aviation Administration's Service Difficulty Automatic Data Processing System. During the 2-year period from September 1, 1978, through September 18, 1980, there were 20 reports of such problems. An upward trend in the rate of reporting was noted when nine reports were processed between April 16 and September 5, 1980. Of the nine reports one report cited a defective aluminum retainer screen, and five reports stated that the engine air filter gaskets failed, separated, and lodged in the carburetor/injector air passages which reduced air flow and available engine power. These failures resulted in two accidents and three unscheduled landings. Both accidents and the two unscheduled landings occurred on aircraft equipped with the Brackett air filter.

A search of FAA Service Difficulty Reports conducted in January 1981 indicated that 16 incidents of Brackett air filter system failure were reported between May 3, 1979, and December 5, 1980. These incidents involved four Cessna 177's as well as Beech, Piper, and other Cessna aircraft. Five reports cited failures of the gasket assembly, 10 reports cited failures of the screen assembly, and one report cited a loose seal.

A survey of NTSB briefs of accidents from 1965 through 1979 revealed 14 accidents in which foreign material affected normal operation of the carburetor/injector system. Cessna aircraft were involved in [illegible] of the 14 accidents.

The Brackett Aircraft Company, Inc., formally Brackett Aircraft Specialties, is a source supplier and holder of an FAA type certificate for its engine air filter assemblies. On December 29, 1977, the FAA issued Supplemental Type Certificate (STC) No. SA71GL for a design change for the company's engine air filter assemblies. The STC affected Cessna models 177, 180, 210, and 310 aircraft, Grumman American model AA-1 aircrafts and Piper PA-20 aircraft. The company also issued two Service Bulletins, Nos. 1 and 2, both of which stated that the aluminum retainer screen should be replaced with a steel screen for the aircraft mentioned in the STC. However, both bulletins excluded the Cessna 177 model aircraft.

As a result of the reports of the defective aluminum retainer screen in the air filter assembly, the FAA issued Airworthiness Directive (AD) 78-25-05, effective December 15, 1978. The AD established an inspection requirement of the aluminum retainer screens for failed areas and required replacement of the aluminum retainer screen with a steel screen if failed areas were noted during the inspection. The AD modification was in accordance with STC SA71GL. The AD applied to numerous Cessna aircraft models but did not include the Cessna 177 model.

After AD 78-25-05 became effective, the Brackett Aircraft Company, Inc., issued Service Bulletin No. 3, which superseded Service Bulletin No. 2 and also stated that the aluminum retainer screen should be replaced with a steel screen. Service Bulletin No. 3 also applied to various aircraft models, including some Cessna aircraft; however, the Cessna model 177 aircraft again was excluded. On July 15, 1980, Brackett issued Service Bulletin No. 4 which applied to the Cessna 177, or any aircraft equipped with the Brackett air filter assembly, and required that the aluminum retainer screen be replaced with a steel screen.

The Brackett Aircraft Company, Inc., aware of the filter gasket defects in their engine air filter assemblies, on July 28, 1980, issued Service Bulletin No. 5, which stated that the gaskets had become loose because of the effects of oils, grease, fuel, and loose and improper fitting fasteners that held the filter in place. The company recommended that gasket retainer strips be installed to prevent the gasket from entering the engine induction system in the event the gasket should become loose. Service Bulletin No. 5 included the model number of the air filter used on the Cessna 177 aircraft. The company also has made kits available to upgrade existing filters.

The Brackett Aircraft Company, Inc., informed the Safety Board that its gasket retainer strip will provide a tight fitting filter frame. A tightly fitted filter will squeeze the gasket, prevent deterioration, and prevent greases and solvents from penetrating the bond. A loose fitting filter will cause the gasket to vibrate and allow grease and solvent to penetrate the bond. The president of the Brackett Aircraft Company, Inc., stated that the Cessna 177 aircraft is vulnerable to filter frame vibration.

The Brackett Aircraft Company has advised the Safety Board that they could not supply a sudden request for a large number of kits to upgrade existing installed filters. Both the Brackett Aircraft Company Service Bulletin No. 3 and AD 78-25-05, Brackett Aircraft Specialities, Inc., note that an inspection of the screen gasket assembly should be performed within 25 hours of receipt of the Service Bulletin or Airworthiness Directive. Additional inspections were to be made at 100-hour intervals until the screen assembly was replaced. The airworthiness directive required that the aluminum screen gasket assembly be replaced with a steel assembly within 525 hours after receipt of the AD. The Safety Board believes that AD 78-25-05 should apply to the Cessna 177.

The Safety Board contacted the Cessna Aircraft Company for information on the use of Brackett air filter assemblies on its aircraft. Its designated engineering representative, who also was project engineer on the Cessna 177, stated that the Brackett Company never was a supplier of engine air inlet system for their company and was not an approved vendor for Cessna. However, owners/operators can and do purchase and install Brackett air filters on their aircraft. Even though the Cessna 177 has not been manufactured since 1978, the FAA Registry Section reported that there are 3,166 registered Cessna 177's in the United States.

The Safety Board became aware on February 13, 1981, that the FAA Western Region Aircraft Modification Section, Engineering and Manufacturing Branch (AWE-211), is conducting a special study on the Brackett engine air inlet system. The Safety Board also has been informed that the FAA is considering airworthiness action on this subject.

Because of the upward trend in Brackett air filter defect reports since the issuance of AD 78-25-06 and the two Brackett Aircraft Company, Inc., Service Bulletins, the Safety Board believes that additional corrective measures should be taken to prevent further accidents resulting from air filter failures.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Revise Airworthiness Directive 78-25-05, Brackett Specialties Company, to include all aircraft listed in Brackett Aircraft Company, Inc., Service Bulletin Nos. 3 and 4. (Class II, Priority Action) (A-81-54)
>
> Issue an Airworthiness Directive which would require compliance with Brackett Aircraft Company, Inc., Service Bulletin No. 5, dated July 28, 1980. (Class II, Priority Action) (A-81-55)
>
> Issue a General Aviation Airworthiness Alert to inform all users of Brackett Aircraft Company, Inc., air filter assemblies of the requirements of AD 78-25-05, Brackett Specialities Company, as amended, and of the need to comply with Brackett Aircraft Company, Inc., Service Bulletin Nos. 3, 4, and 5. (Class II, Priority Action) (A-81-56)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and GOLDMAN, Members, concurred in these recommendations. BURSLEY, Member, did not participate.

James B. King

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 13, 1981

Forwarded to:

Mr. J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-57 and -58

Solid-state nonvolatile memories are now available as viable candidates for use as the recording medium in flight recorders. Solid-state is a superb technology for this application since it will result in recorders with no moving parts that are virtually maintenance free.

Solid-state is coming into its own in the computer memory field in general. Available now is a bubble memory board which provides 1.3 million bits of nonvolatile storage. In the aircraft data recording field, several manufacturers have built prototype solid-state crash recorders for United States military applications.

Appendix B, 14 CFR 121 requires that sampled data for a given aircraft parameter be recorded at a given maximum interval (usually one second, depending on the parameter). This technique works well for magnetic tape digital flight data recorders (DFDR) which employ a continuously moving recording medium. However, solid-state DFDR's have no moving medium, and data are stored in physical locations in circuit chips. Implementation of the fixed recording interval specified in the current regulation is not efficient for use with the solid-state recorder. Solid-state memories are most efficient when used to store compressed data.

Currently, several methods are available to achieve data compression, and any of these could well be a viable means of recording accident data. Such methods should be permitted if the manufacturer can prove during certification that his technique allows precise and accurate reconstruction of the required parameters over the specified ranges and that the recorded data are adequate for accident investigation purposes.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend 14 CFR 121.343 to allow use of digital flight data recorders (DFDR) which employ some form of data compression if the manufacturer can demonstrate during aircraft certification that upon recorder readout the required parameters can be reconstructed to the accuracy and ranges specified in Part 121, appendix B, and that the recorded data are adequate for accident investigation purposes. (Class II, Priority Action) (A-81-57).

Amend column 4, "Recording Interval Maximum (Seconds)," appendix B, 14 CFR 121 so that it applies to: (1) the recording interval of continuously recording machines, such as the currently used magnetic tape digital flight data recorder and (2) the data sampling intervals of DFDR's employing data compression. (Class II, Priority Action) (A-81-58)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 22, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-81-59 and -60

On March 25, 1981, a Bell 206L-1 helicopter, N 1077N, was en route from an offshore oil rig to shore when the pilot reported that the engine flamed out. The aircraft was successfully autorotated to the water from a cruising altitude of 500 feet. The pilot and five passengers escaped injury even though the helicopter rolled over during water entry.

The wreckage was subsequently recovered. Disassembly of the engine (Detroit Diesel Allison 250-C28) revealed that the splined adapter, part number 6899243, Revision A, had fractured. This adapter connects the gas generator turbine shaft to the compressor impeller. Preliminary metallurgical examination of the fractured surface indicated fatigue. Total service time on the adapter was 60.6 hours.

The manufacturer reported that the failed adapter was 1 of 47 recently produced and put into service as a product improvement item. The manufacturer also indicated that the adapters have serial numbers by which the adapters could be located through the manufacturer's distributors. The Safety Board is aware that Allison has recently issued a bulletin to operators recommending that engines with these adapters be removed from service. However, we are concerned that some operators may not remove the engines from service because compliance with the bulletin is discretionary.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive to require that those Allison 250-C28 and -C30 engines identified by the manufacturer as having the PN 6899243, Revision A, splined adapters installed be removed from service. (Class II, Priority Action) (A-81-59)

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Review and evaluate the manufacturing processes and quality assurance procedures for these splined adapters to ensure product integrity and safety. (Class II, Priority Action) (A-81-60)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

James B. King

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: June 3, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-81-61 and -62

On November 21, 1980, a Continental Airlines/Air Micronesia, Inc., Boeing 727-92C, N18479, landed short of the runway at Yap Airport, Yap, Western Caroline Islands. The right main landing gear separated at touchdown. Extensive damage to the right wing was sustained when the aircraft slid along the ground resulting in fuel spillage and fire which engulfed the right wing and most of the right side of the fuselage as the aircraft skidded to a stop. The galley door and the two overwing emergency window exits on the right side of the aircraft were not used because of the fire. All 73 occupants, except two crewmembers, escaped through the two left overwing emergency window exits. Those occupants in the rear of the cabin were almost overcome by smoke when they crowded at the ventral airstair door which could not be opened by the flight attendant. 1/

The aircraft cabin was configured to carry both passengers and cargo. The cargo was situated in front of the passengers on two pallets in the forward cabin. With the aircraft in this configuration, the forward left main cabin door was unusable. This configuration was permitted by the Federal Aviation Administration (FAA) when it issued the Boeing Company an exemption from compliance with the certification requirements of Civil Air Regulation (CAR) 4b. However, the FAA required Boeing to install a ventral airstair door emergency opening system on Boeing 727-100 aircraft which could be so configured. This same emergency system also was required on the 131-passenger Boeing 727-100 aircraft before issuing the exemption. 2/ The emergency opening system for the ventral airstair door was necessary to insure the availability of an emergency exit under adverse conditions. The system was designed to provide a positive minimum opening clearance if the normal system failed.

Inspection of the wreckage showed that the control for the emergency opening system for the ventral airstair door had not been activated. The flight attendant stationed in the rear of the aircraft had not been trained in the operation of the

1/ For more detailed information, read Aircraft Accident Report--"Continental Airlines/Air Micronesia, Inc., Boeing 727-92C, N18479, Yap Airport, Yap, Western Caroline Islands, November 21, 1980" (NTSB-AAR-81-7).

2/ A Boeing Company letter, reference 6-7330-1855, dated August 19, 1964, describes the reason for, and the operation of, the ventral door emergency exit system on Model 727 aircraft.

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emergency system and was not aware of the system. Other Air Micronesia flight attendants subsequently were questioned about the ventral airstair door emergency opening system, and none of those questioned was aware of its existence. Examination of Continental's Emergency Procedures Handbook (EPH) revealed no reference or mention of the emergency system. However, the emergency system was described in the FAA-approved flight manual. In fact, the flight manual listed a minimum necessary air pressure for the operation of the emergency opening system as a requirement on the minimum equipment list when the aircraft was flown in the cargo/passenger configuration. After the Yap accident, Continental trained its flight attendants and those of Air Micronesia on the operation of the emergency opening system. Continental also revised its EPH and changed its training simulator to duplicate the emergency controls for the ventral airstair door.

A second problem which became apparent during this investigation involved the inadequate marking and location of the emergency system controls for the ventral airstair door. The controls for both the normal and emergency systems are inside the tailcone area. They are positioned on the left stairwell wall looking aft near the rear pressure bulkhead. Individual access doors cover the controls for both systems. The access door for the normal control is forward of the access door for the emergency control and about 2 1/2 times larger. When the normal access door is opened, it completely hides the emergency system access door. This could be corrected simply by allowing the normal access door to hinge to the left rather than to the right, by relocating the emergency control, or by depicting the location of the emergency control with adequate placards.

Boeing records indicate that as many as 318 of its Boeing 727-100 series aircraft could have been equipped with the ventral airstair door emergency opening system. Records show that 91 of the Boeing 727-100C cargo/passenger aircraft and 164 Boeing 727-100 all-passenger aircraft were manufactured with this system. Subsequently, 63 modification kits were sold. The Safety Board is concerned that operators of these aircraft may not have provided the necessary training on the emergency opening system of the ventral airstair to their crewmembers, as was the case in this accident.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

AFO-200 Require that air carriers operating applicable Boeing 727 aircraft include emergency procedures for operation of the ventral airstair door in their training programs for cabin crews. (Class I, Urgent Action) (A-81-61)

AWS Issue an Airworthiness Directive on applicable Boeing 727 aircraft to require that the location of the emergency operating control for the ventral airstair door be readily apparent regardless of the position of the access door for the normal system control. (Class I, Urgent Action) (A-81-62)

KING, Chairman, and McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations. DRIVER, Vice Chairman, did not participate.

James B. King

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: June 3, 1981

Forwarded to:
Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-63 and -64

At 1755 e.s.t., on January 31, 1981, Northwest Orient Airlines Flight 79, with 43 passengers, departed Dulles International Airport for Seattle, Washington. While climbing through 7,000 feet, the flightcrew noticed severe vibrations in the No. 3 engine, followed by a loud explosion. They shut down the No. 3 engine immediately. There was no fire or prior report of engine malfunction. The flight returned to Dulles and made a safe landing without further incident.

Examination of the Pratt and Whitney aircraft JT9D turbofan engine disclosed that the No. 3 nose cowl assembly and fan case had separated from the aircraft. The No. 2 engine had ingested debris which resulted in foreign-object damage. The source of the debris is still under investigation.

Examination of the No. 30 first-stage, titanium fan blade by Safety Board and Pratt and Whitney metallurgists disclosed that the blade failed because of a fatigue crack that propagated from a burned area on the leading edge of the blade. The burned area appeared to have been caused by a high-energy electrical arc contacting the leading edge of the blade, which produced localized melting of the material. Subsequent rapid cooling to ambient temperatures caused local degradation of material properties and probable cracking of the forged titanium alloy. Visual examination of the blade revealed that the burned area had been mechanically blended after the blade had been shotpeened. The appearance of the microstructure at the fatigue crack origin indicated that portions of the heat-affected area associated with the arc burn had been partially removed by this blending operation. Although the Safety Board was not able to determine the cause of the arc burn, it and the other two known cases since 1969, both with JT9D engines, may have resulted from contact with electrical equipment.

Arc burns in titanium usually cause permanent subsurface damage that drastically reduces the strength of the material. The damage cannot be detected by inspection and cannot be removed by reworking without impairing blade performance.

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The Safety Board believes that the Federal Aviation Administration (FAA) should issue an airworthiness directive which includes a description of arc burn and requires a visual inspection for localized burning on all Pratt and Whitney titanium alloy fan blades and replacement of all affected blades. Furthermore, we suggest that the FAA use the following description in the airworthiness directive:

> Arc burn is evidenced by a small circular or semicircular heat-affected area on the blade surface that may contain shallow pitting, remelting, or cracking. Usually, a dark-blue oxide discoloration is associated with the heat-affected area.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an airworthiness directive which requires a visual inspection for arc burns before and after each rework operation on titanium alloy fan blades from Pratt and Whitney Aircraft JT9D turbofan engines and requires replacement of arc burn-affected blades. We further recommend that a description of arc burn in titanium be included in the airworthiness directive. (Class II, Priority Action) (A-81-63) ANE

> Issue an air carrier maintenance bulletin urging operators and maintenance personnel to use extreme caution with any electrical equipment in the vicinity of titanium alloy fan blades to minimize the possibility of arc burn. This bulletin should also describe the appearance of arc burn in titanium and point out the nature of damage caused by such burns and the possible consequences of this damage. (Class II, Priority Action) (A-81-64) AWS

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

James B. King

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: June 23, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-65 through -68

On January 21, 1981, at 0844 e.s.t., a Georgia-Pacific Corporation Cessna Citation, N501GP, with the pilot, the copilot, and three passengers aboard, overran the end of runway 23 following an instrument landing system (ILS) approach, crashed, and burned at the Mercer County Airport, Bluefield, West Virginia. The aircraft touched down between 500 and 2,000 feet on the runway which was covered with wet snow, and it did not decelerate normally. About 1,200 feet from the departure end of the runway, the pilot added engine thrust and rotated the aircraft for liftoff; however, it did not get airborne because of insufficient flying speed. The aircraft overran the end of the runway and struck three localizer antennas and a 10-foot embankment before it plunged down a steep, densely wooded hillside. All five occupants were killed, and the aircraft was destroyed by impact forces and postcrash fire. 1/

The length of runway 23 is 4,742 feet; it is 100 feet wide and has a 0.3 percent effective downslope gradient. The runway is also grooved. The remaining runway beyond the glide slope touchdown point is 3,685 feet. The weather conditions at the time of the approach were: 700 feet, overcast, visibility 1 mile, light snow and fog, temperature 32° F, wind 070° at 10 knots and the braking action was reported poor.

The computed Vref for the approach was 107 KIAS. According to the Federal Aviation Administration (FAA) approved aircraft flight manual (AFM), the dry runway field length required with a 10-knot tailwind for the landing aircraft was 2,625 feet. Takeoff and landing performance data in the AFM are based only on a paved dry runway. The AFM does not contain correction factors to use in computing landing field length requirements when landing on wet or icy runways. However, according to the manufacturer's aircraft operating manual, which contains

1/ For more detailed information, read Aircraft Accident Report--"Georgia-Pacific Corporation Cessna 500 Citation, N501GP, Mercer County Airport, Bluefield, West Virginia, January 21, 1981" (NTSB-MAR-81-9).

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information not required by regulation, a pilot can expect landing field length requirements to increase over the AFM values by 50 percent if the runway is wet, and 100 percent if it is icy. It is the Safety Board's understanding that these correction factors were based on National Aeronautics and Space Administration (NASA) test data for landing with low braking coefficients and from a computer model developed by the Cessna Aircraft Company. Using these factors, 3,937 feet of runway would have been required to stop the aircraft on a wet runway, and 5,250 feet would have been required to stop the aircraft on an icy runway. Furthermore, the maximum landing tailwind component for the aircraft is 10 knots, and at the time of the accident, about 9 knots was present. An excerpt from page IV-3 of the aircraft operating manual states the following:

> With 100 p.s.i. main tires, the CITATION's minimum dynamic hydroplaning initiating groundspeed is 90 kns. At typical landing weights, touchdown is normally accomplished below that speed. Since groundspeed is the critical factor, landing on slick runways with any tailwind component should be avoided.

In accordance with British Civil Airworthiness requirements, Citation aircraft manufactured for export to Great Britain have revisions to the AFM which, in part, increase the landing field lengths by 220 percent on wet and icy runways and restrict operators to landings only into a headwind and on a runway with an uphill gradient. The caution in the aircraft operating manual, therefore, indicates that the foregoing correction factors are inadequate when landing on wet or icy runways with a groundspeed in excess of 90 knots.

The pilot of the accident aircraft had a total of 10,463 hours of flight time; 7,609 hours as pilot-in-command, 5,002 hours in multiengine turbojets, and 3,642 hours in the Citation. A pilot with this amount of experience would be expected to be capable of achieving a thorough knowledge of the performance characteristics of his aircraft by, in part, reviewing all the pertinent aircraft information made available by FAA and the manufacturer. The Safety Board believes that the pilot was aware of the adverse runway condition and the aircraft's limitation to stop on the runway available because of his first attempt to land on runway 05 and the tailwind component present during the second approach to runway 23. Although the Safety Board believes that the pilot exercised poor judgment in attempting a landing on runway 23, it believes that the correction factors used in computing the required landing field length data and the effect the tailwind has on these correction factors are critical information to the safety of flight; therefore, this information should also be included in the AFM. The absence of this information in the AFM appears to be inconsistent with FAA's attempts at achieving a level of safety in accordance with previous practice. An example is the inclusion of similar runway condition correction factors in the AFM for the Gates Learjet aircraft.

A review of the Safety Board's accident files for the period 1970 to 1980 disclosed four other Citation overshoot accidents which involved water/ice on the runway under unfavorable wind conditions. A fifth accident involved a loss of control on takeoff and an attempted abort with an 11-knot tailwind and blowing snow. The range of total flight experience of the pilots involved in these accidents was between 2,600 and 10,000 hours and the total flight time in type ranged between 250 and 750 hours.

The Safety Board believes there is a legitimate need to emphasize and reinforce the landing performance of the Citation under wet and icy runway conditions and that the critical factor under these conditions is groundspeed. It should be made clear that

any landing in excess of 90 knots should not be attempted under the foregoing conditions and the required landing distance cannot be determined because the correction factors used are not adequate. The importance of this information was recognized by the British Civil Aviation Authority by its modification of the AFM and the inclusion of additional restrictions.

It should also be noted that reliable runway condition correction factors involving solid ice, snow, or slush are most difficult to determine and, therefore, a pilot should be skeptical of those correction factors when a landing attempt is made on a runway with either of these surface conditions. The inclusion of that information in the AFM by the manufacturer should serve as a warning that a hazardous situation may be encountered under these conditions.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Require Cessna to include in the appropriate sections of all Citation aircraft flight manuals the portion of page IV-3 of the manufacturer's aircraft operating manual which pertains to landing on slippery runways. (Class II, Priority Action) (A-81-65)
>
> Require Cessna to include in the appropriate sections of all Citation aircraft flight manuals a warning that solid ice, snow, or slush corrected landing distances may not be adequate in operations. (Class II, Priority Action) (A-81-66)
>
> Through advisory circulars and/or operations bulletins, emphasize and reinforce in the training curricular for at least all turbojet initial and recurrent phases the limitations and the hazards that may be encountered when landing on slippery runways. (Class II, Priority Action) (A-81-67)
>
> Review and require revisions, as appropriate, of manufacturer's aircraft flight manuals to include sufficient slippery runway condition correction factor information or require an appropriate warning that landing distances under slippery runway conditions are unknown. (Class II, Priority Action) (A-81-68)

DRIVER, Vice Chairman, and McADAMS and BURSLEY, Members, concurred in these recommendations. KING, Chairman, and GOLDMAN, Member, did not participate.

By: James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: June 29, 1981

Forwarded to:

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-81-69

On December 7, 1980, both engines of a Continental Oil Company Lear Model 25 flamed out at about 40,000 feet while the aircraft was climbing to 43,000 feet northwest of Childress, Texas. An emergency descent was made through heavy rain, turbulence, and lightning, during which airstart attempts were not successful. However, after passing through 25,000 feet, the engines were restarted and the aircraft made a precautionary landing at Childress. No one was injured, and the aircraft was not damaged.

An investigation into the cause of the flameouts was conducted by the Safety Board with the assistance and cooperation of the Federal Aviation Administration's New England Region Engineering and Manufacturing Branch and the General Electric Co., the engine manufacturer.

Extensive testing and a teardown examination of the General Electric CJ610-6 engines determined that the flameouts were caused by reduced engine stall margin due to excessive compressor blade tip clearance and excessive compressor case runout. Although both engines had been overhauled shortly before the incident, no evidence was found to confirm that the problem could have originated at overhaul. The manufacturer could not explain the cause of the case runout and tip rub that led to increased clearances.

A review of the service history between 1976 and 1980 of General Electric CJ610-6 engine-equipped Lear aircraft revealed at least 30 other instances of engine flameout at altitude, although the December 7, 1980, incident was the only reported instance of the loss of both engines. Sixteen of the reported flameouts were attributed to excessive compressor clearances. Nearly all of the flameouts occurred at altitudes near or above 40,000 feet. Some other aircraft are equipped with CJ610-6 engines, but those aircraft are generally operated at lower altitudes than the Lear aircraft. The service history of those aircraft has been reviewed and only two incidents of flameout were reported during the same period.

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The Safety Board is aware that the engine and aircraft manufacturers are conducting a test and research program to develop a solution to the loss of engine stall margin. However, we are concerned that until a method is developed for recovering or preventing reduction of stall margin, the potential for an accident exists. Because the engine maintenance and overhaul manuals provide a method for determining loss of stall margin, the Safety Board believes it should be used periodically to check engines for decreased stall margin and that appropriate operating restrictions should be applied to those engines so identified.

The manufacturer has proposed a one-time altitude stall and acceleration check to identify engines for which a stall margin recovery fix would be necessary. However, those engines which pass this check may later develop a reduced altitude stall margin. For this reason, the Safety Board believes the check should be required periodically to identify engines which might be susceptible to altitude flameout.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive to: (1) require, at appropriate periodic intervals, the performance of the altitude acceleration and stall check procedure defined in the CJ610-6 overhaul manual on Lear aircraft with General Electric CJ610-6 engines installed; and (2) restrict the maximum operating altitude of those engines shown by the test procedure to have a reduced altitude stall margin until the manufacturer has developed a satisfactory method for recovering stall margin and it is incorporated in those engines. (Class II, Priority Action) (A-81-69)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

By: James B. King
Chairman

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

April 3, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-125 through 80-131 issued by the Board on December 31, 1980. These recommendations resulted from the Board's assessment of the adequacy of occupant protection in general aviation aircraft during a crash. This also responds to NTSB Safety Recommendations CY-70-42, Part 4, and A-77-70, which were reiterated as a part of this recommendation package.

CY-70-42, Part 4. [Initiate] regulatory action . . . to raise the "minor crash landing" inertia forces of [14 CFR] 23.561 to a level comparable to those produced by a moderate-to-severe crash landing. Until a reasonable crash design condition is decided upon, including a specified crash acceleration pulse, it is suggested that the longitudinal inertia force be raised to 20 to 25 and the forces about other axes be similarly increased. (Recommendation Status: Previously closed when the FAA issued an NPRM whose requirements, if made final, would have accomplished the recommended action.)

FAA Comment. The Federal Aviation Administration (FAA) does not concur in pursuing action that would arbitrarily raise the longitudinal inertia forces to 20-25 g's, until a reasonable dynamic design condition is decided upon. In testimony before the House Subcommittee on Oversight and Review on June 3, 1980, Chairman King stressed the importance of energy absorbing seat designs for transport category airplanes. Energy absorbing seats are even more desirable in general aviation airplanes because of the reduced amount of energy absorbing fuselage material beneath the occupant. Raising the static inertia forces for design of seats will make the seats stronger and also stiffer. Thus, more of the crash load will be transmitted to the occupant, and presently survivable crashes may become unsurvivable. The approach the FAA is taking, which we believe to be the correct one, is to define the dynamic crash input and then "tune" the seat deflection and energy absorption characteristics for maximum occupant survival. We will keep the Board informed of significant progress in this research effort.

A-77-70. Amend 14 CFR 23.785 to require installation of approved shoulder harnesses at all seat locations as outlined in NPRM 73-1. (Recommendation Status: Open, Unacceptable Action)

FAA Comment. The FAA is studying the feasibility of requiring installation of approved shoulder harnesses at all seat locations under an existing regulatory project. In this feasibility study many schemes for accomplishing shoulder harness retrofit are being considered in addition to changes to FAR 23.785, which would affect only new type designs. The economic impact of the various schemes is being carefully assessed. The FAA is also working on a proposed shoulder harness technical standard order (TSO) that will contain specific design requirements for shoulder harnesses. The FAA will keep the Board informed of progress in these two efforts, and we will provide copies of any NPRM or TSO issued.

A-80-125. Require that those general aviation aircraft manufactured to include attachment points for shoulder harnesses at occupant seats be fitted with shoulder harnesses no later than December 31, 1985, and, in the interim, require this modification as a requisite for change in FAA registration.

FAA Comment. In the shoulder harness retrofit study discussed in our response to recommendation A-77-70, the FAA will assess this scheme for retrofit. Extensive effort is necessary to identify exactly which airplane models have acceptable shoulder harness attachment points. At this time, we do not believe that this retrofit scheme is a fair and equitable scheme since it may impact owners of one type of airplane more severely than owners of another type. This apparent inequity will be assessed in our study, and we will keep the Board informed of significant progress in this area.

A-80-126. Develop, in coordination with airframe manufacturers, detailed, approved installation instructions for installing shoulder harnesses at each seat location in current models and types of general aviation aircraft in which shoulder harness attachment points were not provided as standard equipment. Publish and provide these instructions to owners of these aircraft by December 31, 1982.

FAA Comment. The FAA, under the Federal Aviation Act of 1958, is not legally empowered to expend government resources in order to develop detailed, approved installation instructions. Nor should the agency be involved in other detailed design of airplanes that it regulates, or publication of instructions provided to airplane owners at the taxpayers' expense. Such design functions are the responsibility of the aircraft type certificate holder or owner. Should the FAA issue a requirement to retrofit shoulder harnesses on airplanes not having attachments, the manufacturers of the airplane will undoubtedly provide an FAA-approved service bulletin accomplishing the installation. We do not believe the provisions of this recommendation are within the scope of FAA's responsibility. Accordingly, we intend to take no further action on Safety Recommendation A-80-126.

A-80-127. Require that those general aviation aircraft for which FAA-approved harness installation instructions have been developed be fitted with shoulder harnesses at each seat location no later than December 31, 1985, and, in the interim, require this modification as a requisite for change in the FAA registration.

FAA Comment. Since the recommendation specifies installation of shoulder harnesses in accordance with FAA-approved instructions prepared under Safety Recommendation A-80-126, the FAA believes this recommendation is also outside the scope of FAA's authority. However, the recommendation is identified as another scheme for retrofitting shoulder harnesses which will be considered in the evaluation discussed in our response to recommendation A-77-70.

A-80-128. At established intervals, extend the application of all newly established occupant protection provisions of 14 CFR 23 to all newly manufactured general aviation aircraft.

FAA Comment. It is not clear to us what occupant protection provisions are referred to in this recommendation. It will be helpful if the Board will identify precisely which paragraphs of Part 23 are referred to in this recommendation for retrofit action, and identify the specific accident or unsafe condition used to conclude that retroactive application of existing rules is necessary. In the absence of a clearly defined unsafe condition, the FAA does not believe that the blanket retroactive application of occupant protection provisions is appropriate. Upon receiving further clarification, the FAA will again consider Safety Recommendation A-80-128.

A-80-129. Revise 14 CFR 23.785(j) to incorporate performance standards and test criteria to insure that an acceptable level of occupant safety is achieved through cabin "delethalization."

FAA Comment. The requirements of Part 23 are intentionally general, thereby providing the desired intent of the regulation which allows the manufacturer freedom to design the airplane as he desires. Advisory material, such as FAA Technical Report No. FS-70-592-120A, has been issued to assist in compliance with the "delethalization" rule. In the area of cabin delethalization, there are many different designs, making it impossible to develop one set of test criteria and performance standards to adequately cover all designs. The requirement for shoulder harnesses in the front seats of general aviation airplanes, we believe, has been highly effective in delethalizing this area of the airplane. The FAA does not believe it is feasible to proceed in accordance with Safety Recommendation A-80-129, because of the broad, general scope of the recommended undertaking. However, we are receptive to any suggestions for specific test criteria or performance standards, and stand ready to evaluate all material presented. Pending more definitive criteria, FAA intends to take no further action on Safety Recommendation A-80-129.

A-80-130. Revise current standards for seat and restraint systems to incorporate needed crashworthiness improvements identified in FAA Research Project reports.

FAA Comment. Again, the FAA concurs with the intent of this recommendation, but we believe more specific information is required regarding which crashworthiness improvements are suggested and, specifically, which regulatory changes are desired. We are sensitive to research projects which result in recommendations that appear technically feasible, but cannot be converted into enforceable regulations because of environmental, cost, or other factors not envisaged during research. The FAA plans no further action on Safety Recommendation A-80-130 pending receipt of more definitive guidelines.

A-80-131. Establish standards for the dynamic testing of occupant protection devices required in general aviation aircraft.

FAA Comment. On June 2, 1975, the Board issued Safety Recommendation A-75-51, recommending that FAR 23.785(f) be revised to require dynamic testing of seats. The FAA has already responded to that recommendation, stating that dynamic testing of seats could not be undertaken until the dynamic load characteristics of the crash are better understood. If dynamic tests are eventually undertaken by the FAA, they, of necessity, would include testing of the seat with a representative occupant fastened to it using the seat belt and shoulder harness, if installed. Thus, dynamic testing of seats would include

dynamic testing of the seat belt and shoulder harness. To our knowledge, these two occupant protection devices are the only devices that need to be tested to a dynamic impact. If we are to understand that the occupant protection devices referred to in this recommendation are the seat belt and shoulder harness, please note that these items will be tested in the course of the dynamic seat tests. If it is suggested that other protection devices be tested, please identify these devices and give us the benefit of your rationale for recommending dynamic testing. In the interim, the FAA intends to continue our research efforts, and we will keep the Board informed of significant progress in this area.

The preceding response applies only to general aviation aircraft. The Board is aware that in addition to the FAA's program to evaluate the desirability of dynamic testing of general aviation seats, there is a parallel program for transport category seats. Although similar, these two programs must be considered as separate issues. The transport category seat occupant has a considerable amount of airplane structure beneath the seat to absorb crash energy which the general aviation seat does not, and it would appear that energy absorption within the seat itself is the most viable means of reducing occupant crash forces and injury. The FAA is in the process of conducting static and dynamic transport seat tests at the Civil Aeromedical Institute which will evaluate the response of seats to a specific dynamic pulse and measure the effect of specified floor deformation criteria on seat failure modes.

Sincerely,

Charles E. Weithoner
Acting Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

DEC 27 1979

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Dear Mr. Bond:

On February 1, 1979, we met to discuss Federal Aviation Administration (FAA) actions relative to shoulder harnesses in general aviation aircraft. You agreed at that meeting to reevaluate the FAA position on this matter. While we have exchanged several additional letters since your February 15, 1979, letter indicating your decision to reconsider the issues involved--the most recent being your letter of September 24, 1979--the National Transportation Safety Board continues to be concerned with the pace at which this subject is being addressed.

Because the subject of occupant protection in general aviation is of such vital importance, we are anxious to know what specific actions you have taken in your reconsideration and when a decision can be expected. We urge you to provide your decision to the Board as early as possible, and ask that you advise us of your timetable for completing your reconsideration and reaching a decision.

In the meantime, the Safety Board needs certain information previously requested for our ongoing review of this subject. Approximately one year ago (on November 16, 1978), we requested by letter that the FAA provide copies of the cost-effectiveness analysis information it used to support the decision in amendment 23-19 and 91-139 not to require the retrofit of shoulder harnesses in pre-1978 general aviation aircraft, as well as the data substantiating FAA's claim that delethalization was more effective than shoulder harnesses for all seat occupants. This information has not been provided nor has the FAA furnished any justification for the delay in providing this information. Evaluation of the cost-effectiveness analysis and supporting documentation is critical to the Board's review of the FAA's decision not to require improved safety for occupants of general aviation aircraft.

Our November 16, 1978, letter to you also requested information about the FAA's decision to delethalize the interior of general aviation aircraft, about the criteria the FAA would use to determine if manufacturers meet this requirement, and about the methods the FAA would use to assure that the criteria were uniformly applied throughout the Regions. Again, this information has not been provided. The Safety Board, therefore, requests that you provide the requested information and a status report about the progress made to date by manufacturers to comply with this requirement.

It is essential that the Safety Board have this information in order to evaluate the combined effect of these decisions on the safety of general aviation aircraft occupants. Consequently, we ask that you provide the information requested in our November 16, 1978, letter at the earliest practicable date.

Sincerely,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

September 24, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to your letter of June 5 which requests information about any conclusions we may have reached in the matter of shoulder harnesses for general aviation aircraft.

As you mentioned, we are conducting a regional survey of shoulder harnesses in all small airplanes on the U. S. Civil Aviation Register. Until this survey is completed we are not in a position to make any conclusions or a cost-effectiveness assessment of a retrofit requirement.

We will advise you of our conclusions as soon as we have completed our evaluation.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

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SUMMARY OF FEDERAL AVIATION ADMINISTRATION RESPONSES TO NATIONA--ETC(U)
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National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

June 5, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

In your letter of February 15, 1979, on the subject of shoulder harnesses for general aviation aircraft, you stated that your staff would carry out an analysis of the issues involved. Since our Safety Board staff has been maintaining close liaison with members of your staff, we are aware and appreciative of the extensive involvement of many of your offices engaged in the research and analysis of this problem.

It is my understanding that considerable work has been done and that some conclusions already may have been reached to enable a possible viable resolution of the problem. Without disturbing or prejudicing the ongoing study, I would very much appreciate being advised of any conclusions that have been reached, particularly with regard to the cost effectiveness of the shoulder harness retrofit.

Sincerely yours,

James B. King

James B. King
Chairman

National Transportation
Safety Board

Washington, D.C. 20594

Office of the
Chairman

March 5, 1979

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

We have reviewed your February 15, 1979, response to our letter of November 16, 1978, concerning shoulder harnesses in general aviation aircraft and the delethalization of light-aircraft cabins. The Safety Board is pleased that you have taken steps to reconsider your earlier decisions relative to these very important safety matters.

Regarding your statement that the Board may have additional information bearing on the issues, we are not certain as to what further information would be germane other than the information contained in our investigative reports. However, we would be pleased to have your assigned personnel meet with Safety Board staff members to discuss any available information. Mr. Gerrit J. Walhout, Chief, Human Factors Division, will be available to meet with your staff personnel, at a mutually agreed time and date, to review the issues and to discuss any additional information we may have.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

February 15, 1979

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594

Dear Mr. Chairman:

Thank you for your letter of November 16, 1978, in which you discuss several important issues regarding the installation of shoulder harnesses in general aviation aircraft. As you reviewed in your letter, our June 16, 1977, amendments to Parts 23 and 91 of the Code of Federal Regulations, Title 14, were the most recent actions we have taken in this regard.

Based on the information available to us at the time of our decisions on those amendments, the agency determined that a shoulder harness retrofit requirement was not appropriate. Further, it was also believed that delethalization of light aircraft cabins would be preferable to a requirement that all seats be equipped with shoulder harnesses, and we followed that course of action.

In the last few months, I have come to the conclusion, however, that our earlier decisions regarding these issues should be reconsidered. I have directed Mr. Charles R. Foster, Acting Associate Administrator for Aviation Standards, to carry out an analysis of these issues and provide me with recommended options. From the content of your November 16, 1978, letter it appears that the Board may have information which could have a bearing on our reanalysis of these issues. If your staff has any such new information, I ask that you provide it to us so that we may be sure to fully consider all relevant data.

The specific points raised in your November 16, 1978, letter are good ones, and I have requested that they be included in our analysis. I will provide you with a detailed response to those questions as soon as I am satisfied that all available information has been properly taken into account.

Thank you for your expression of concern.

Sincerely,

Langhorne Bond
Langhorne Bond
Administrator

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

16 NOV 1978

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

At the regular NTSB/FAA Quarterly Meeting on July 18, 1978, the subject of requiring shoulder harnesses for all seat locations in general aviation aircraft was discussed. The response from Acting Administrator Quentin S. Taylor, concerning Safety Recommendations A-77-70 and 71, was also discussed and additional information relative to the past history of shoulder harness installations was reviewed. The Safety Board remains concerned that all passengers are not adequately protected by the recent rulemaking which made mandatory shoulder harnesses at front seats only.

The history of the Board's concern dates from August 28, 1970, when the Board issued recommendation CY 70-42. The recommendation addressed several areas which the Board regards as vital for the crashworthiness of aircraft. Among these were the two following recommendations:

1. Require shoulder harnesses in all general aviation aircraft at the earliest practical date.

2. Delethalize aircraft interiors.

On September 9, 1970, the FAA responded that a Notice of Proposed Rulemaking was being prepared. NPRM 73-1 was issued on January 31, 1973; it proposed to require shoulder harnesses on all seats in light airplanes and it incorporated a retroactive clause. The Board expressed its satisfaction with the NPRM and suggested additional improvements. On June 16, 1977, 14 CFR 23 and 14 CFR 91 were amended to make shoulder harnesses mandatory for the front seats of all small airplanes manufactured after July 18, 1978. Delethalization was also made mandatory to protect the passengers when inertia forces are experienced as prescribed in FAR 23.561(b)(2). These forces are equal to: upward - 3g, forward - 9g, and sideward - 1.5g, which are considerably less than those forces experienced in many survivable aircraft accidents.

Although CY 70-42 was closed, on December 7, 1977, the Board issued recommendations A-77-70 and 71, reiterating the Board's concern on the inadequacy of the new rules since they applied only to the front seats in new aircraft. Currently, A-77-70 and 71 are being held in an "Open - Unacceptable Action" status because of FAA's response that there is insufficient justification to impose the additional cost of shoulder harness installations to owners of older aircraft. The Board would be interested in receiving FAA's cost-effectiveness analysis information that was used to determine the fact that a shoulder harness retrofit modification would be impractical. As a matter of fact, the Civil Aeromedical Institute reports that Cessna Aircraft Company has been providing structural "hard points" for shoulder harnesses since 1957. Beech Aircraft Corporation also offered factory-installed shoulder harnesses in the past, but discontinued the harnesses after three years.

Since shoulder harnesses are mandatory on new aircraft, after July 18, 1978, it would appear that the "hard points" in these aircraft could be used for shoulder harness installations. The Safety Board would appreciate information regarding the number of manufacturers which have engineered shoulder harness "hard points" in their aircraft.

With regard to FAA's contention that light aircraft cabins will be "delethalized" in lieu of shoulder harness installations for occupants of rear seats, we would also like to know:

1. What data does the FAA have to indicate that delethalization of cabin interiors will prevent the types of injuries commonly found in survivable accidents?

2. Why does the FAA consider delethalization more effective than shoulder harnesses. What data substantiates that claim?

3. What criteria exist or will be developed for the "delethalization" of cabins?

4. How will these criteria be applied?

5. How will FAA assure that such data will be applied universally between all Regions?

With regard to possible retrofitting of older aircraft with shoulder harnesses at the option of the owner, the Board would like to know how the FAA visualizes the dissemination of structural analyses to owners of aircraft who wish to install shoulder harnesses. For example, an aircraft owner in New York may be unaware that FAA-approved data applicable to his aircraft already exist in Florida.

Therefore, the National Transportation Safety Board would appreciate receiving the information requested above in an attempt to reach closure on these important recommendations.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

February 8, 1978

Honorable Kay Bailey
Acting Chairman
National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Miss Bailey:

This is in response to NTSB Safety Recommendations A-77-70 and A-77-71.

A-77-70. Amend 14 CFR 23.785 to require installation of approved shoulder harnesses at all seat locations as outlined in NPRM 73-1. (Class II - Priority Action)

A-77-71. Amend 14 CFR 91.33 and .39 to require installation of approved shoulder harnesses on all general aviation aircraft manufactured before July 18, 1978, after a reasonable lead time, and at all seat locations as outlined in NPRM 73-1. (Class II - Priority Action)

Comment. The substance of these recommendations was considered in the rulemaking process that resulted in amendments to Parts 23 and 91 adopted June 9, 1977. The Safety Board implies in its Recommendations A-77-70/71, that the amendments to paragraphs 23.785, 23.1307, 91.7, 91.33 and 91.37 are an improvement for crash survivability.

In consideration of the comments received on NPRM 73-1, the FAA was unable to justify amendments that would have included all aspects of the proposal. The Board's Recommendations A-77-70/71 issued approximately six months after the various amendments were adopted reiterates proposals contained in NPRM 73-1. Those proposals were not supportable in the rulemaking process nor can the FAA find that these recommendations provide new information to justify another rulemaking action on the subject at this time.

Amendment Numbers 23-19 and 91.189 set forth in detail the reasoning for the withdrawal or adoption of proposals in NPRM 73-1 pertaining to the installation and use of shoulder harnesses in small airplanes. A copy is enclosed for placement in the recommendation docket with this letter.

Sincerely,

Quentin S. Taylor
Acting Administrator

Enclosure

25

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: December 8, 1977

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-77-70 and 71

On June 16, 1977, the Federal Aviation Administration amended 14 CFR 23 and 91 to require the installation and use of shoulder harnesses on small general aviation aircraft. The amended airworthiness standards of 14 CFR 23 now require that front seats of general aviation aircraft be equipped with approved safety belts and shoulder harnesses, and the amended operating and flight rules of 14 CFR 91 require that shoulder harnesses be installed at each front seat location and be worn during takeoff and landing. These regulations, which become mandatory for flight crewmembers on all aircraft manufactured after July 18, 1978, represent a notable improvement to occupant safety.

Although the National Transportation Safety Board is encouraged by FAA's commitment to improving crash survivability, it believes that occupants of the existing fleet of fixed-wing general aviation aircraft -- over 164,000 active airplanes -- will be denied the level of protection afforded the occupants of aircraft manufactured after July 18, 1978. Furthermore, the occupants of seats other than front seats also will be denied the benefit of the impact protection afforded by shoulder harnesses.

For example, on December 2, 1976, a Beech-Debonair crashed near Glenville, New York. The aircraft cabin remained structurally intact, providing a survivable environment. However, the pilot was killed when he struck the control yoke; a broken rib punctured the pilot's heart. The Safety Board's investigation disclosed that seats did not fail and that, had the pilot been wearing a shoulder harness, upper torso rotation would have been reduced and the thoracic injury prevented.

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On July 12, 1975, a Piper PA-28 crashed near Leadville, Colorado. Investigation revealed that the right front seat shoulder harness was inoperative and was not being worn by the occupant, who died when he struck the control yoke and instrument panel. The occupant of the left front seat was wearing a shoulder harness and survived. The aircraft maintained a survivable occupant environment.

More recently, on August 26, 1976, a Piper PA-28 crashed near Lake City, Colorado, and on March 30, 1976, a Cessna C-340 crashed near Ruidoso, New Mexico. These accidents were similar to those cited above, in that cabin integrity was maintained but front seat occupants were killed. Moreover, it is significant that, in the Lake City PA-28 accident, the two children in aft cabin seats were fatally injured. Our investigators noted that the front seats remained virtually intact, yet the two children received severe head injuries. The circumstances of these two accidents and the occupant injuries indicate that had the occupants been wearing shoulder harnesses they would have survived.

On August 28, 1970, the Safety Board recommended that the FAA require shoulder harnesses on all general aviation aircraft at the earliest practical date. When Notice of Proposed Rule Making (NPRM) 73-1 was issued, the Safety Board supported the proposed rule changes. However, during the rulemaking process, major portions of NPRM 73-1 were deleted. As a result, the amendments to 14 CFR 23 and 91 now require that shoulder harnesses be installed at front seat locations only and the amendments limit the requirement to aircraft manufactured after July 18, 1978. The argument against retrofitting existing general aviation aircraft with shoulder harnesses was based on the contention that a "substantial financial burden would be placed upon consumers over a short period of time" (1 year). Moreover, the installation of shoulder harnesses on other than front seats was rejected on the contention that cabin interiors can be effectively designed to protect those occupants; i.e., cabins can be "delethalized."

The Safety Board does not agree with these arguments and believes that shoulder harnesses should be installed in older aircraft and that they should be installed at all seat locations. The Safety Board believes that rejecting the retrofit aspects of NPRM 73-1 on the grounds that this would place a financial burden on consumers "over a short period of time" is not warranted. A compliance date could have been established which would have allowed aircraft owners ample time to comply without encountering a short-term financial burden. (Compliance for noise and emission standards are being handled in such a way.) Neither does the Safety Board believe that current cabin delethalization requirements will provide occupants of aft cabin seats protection comparable to occupants wearing shoulder harnesses. The Board maintains that cabin delethalization in conjunction with the use of shoulder harnesses will provide the occupants of all seats the best impact protection.

The Civil Aeronautical Authorities of both Sweden and Australia require shoulder harnesses on all general aviation airplanes before an airworthiness certificate is issued. This requirement has been in effect in Sweden since 1970 and Australia since 1973; the general aviation fleets of both countries largely consist of U. S. manufactured aircraft.

In view of the above, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend 14 CFR 23.785 to require installation of approved shoulder harnesses at all seat locations as outlined in NPRM 73-1. (Class II - Priority Action) (A-77-70)
>
> Amend 14 CFR 91.33 and .39 to require installation of approved shoulder harnesses on all general aviation aircraft manufactured before July 18, 1978, after a reasonable lead time, and at all seat locations as outlined in NPRM 73-1. (Class II - Priority Action) (A-77-71)

BAILEY, Acting Chairman, McADAMS, HOGUE, and KING, Members, concurred in the above recommendations.

Kay Bailey

By: Kay Bailey
Acting Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

DATE: April 3, 1981

IN REPLY REFER TO:

SUBJECT: Memo to the file: NTSB Safety Recommendation CY-70-42

FROM:

TO:

Part 4 of NTSB Safety Recommendation CY-70-42 was officially classified by the Board as "CLOSED" in November 1972.

9 SEP 1970

Honorable John H. Reed
Chairman, National Transportation
  Safety Board
Department of Transportation
Washington, D. C. 20591

Dear Mr. Chairman:

This will acknowledge your 28 August 1970 letter concerning a petition for rule making in the small-aircraft crashworthiness area.

We have responded to the petition by means of the enclosed Disposition of Petition. You will note that we have emphasized in that disposition that we have conducted a number of years of basic research and development work in this very complex area. We also point out that part of this research effort has been translated into new rules effective 14 September 1969 covering airplanes for which application for type certificate is made after that date. In addition, we indicate that we are hard at work on additional rules proposals and a notice of proposed rule making is underway.

We would like to emphasize that we will always be responsive to reasonable and responsible recommendations for regulatory improvements from any person within or without the Government. In this context we want to assure you that your specific recommendations will be taken into account in the preparation of our proposed rule making. We will be in touch with your technical people to discuss those recommendations in considerable detail.

Sincerely,

[illegible]al Signed By
[illegible]
ACTING ADMINISTRATOR

DEPARTMENT OF TRANSPORTATION
NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20591

OFFICE OF
THE CHAIRMAN

AUG 28 1970

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Department of Transportation
Washington, D. C. 20590

Dear Mr. Shaffer:

Some time ago the Safety Board received a copy of the Nader group report entitled "Crash Safety in General Aviation Aircraft." Our staff has reviewed this report and found it to be comprehensive. The findings of the report form the basis for the petition filed with the FAA by Mr. Ralph Nader. The purpose of this letter is to convey to you our views on general aviation crash safety so that you may consider them during your delibetation on the action to be taken with respect to the Nader petition.

Our view is that the aircraft manufacturers, on the one hand, have concentrated their efforts on the airworthiness aspect of their product, and have minimized their efforts to provide realistic levels of crash-worthiness. Medically-oriented researchers and crash safety specialists, however, have built up a considerable body of technical data showing that significant savings in lives and injuries can accrue to improved crash-worthiness in the design of aircraft. Much of this data has been developed by your agency at CAMI and NAFEC and through FAA-sponsored research grants.

The Federal Air Regulations, however, still only provide protection for "a minor crash landing." We recognize that you are required by statute to regulate only minimum standards for air safety as contrasted with optimum standards. Also, we know that you must have good cause before you change the existing regulations. However, we believe that it is time to take a new look at minimum standards as they are applied in the general aviation crash safety field. In the light of the aforementioned crash safety research data, we think that the existing crash safety standards in FAR Part 23 do not encourage practical application of existent state of the art The National Highway Safety Bureau, with essentially the same basic data that the FAA now possesses, has forged ahead in the automotive field to provide substantial crash-worthiness protection for occupants of automobiles.

Accordingly, we recommend that you reevaluate your position on minimum general aviation crashworthiness standards, considering at least the following points:

1. Shoulder Harnesses

Shoulder harnesses should be required on all general aviation aircraft at the earliest practical date. The recent Amendment 23-7 is a step in the right direction but does not go far enough. The draft report made by your Dr. John Swearingen on crash injury further provides corroborative proof of the benefit of shoulder harnesses in general aviation aircraft.

2. Delethalization of Aircraft Interiors

Suitable energy-absorbing padding should be required on all interior structures to protect the occupants. All protuberances likely to cause injury should be eliminated or suitably recessed. Dr. Swearingen's recent work highlights the injury saving potential of such crashworthiness design features.

3. Dynamic Testing of Seats

Considerable research data are available, pointing to the need for dynamic testing of aircraft seats. Static tests alone are not realistic, and cannot directly be related to crash environments. These conclusions are verified by the work covered in your Aircraft Development Service Report NA-69-5, "Dynamic Test Criteria For Aircraft Seats." Therefore, we request that you initiate regulatory action to implement the recommendations in this report.

4. Emergency Landing Conditions

Regulatory action should be initiated to raise the "minor crash landing" inertia forces of FAR 23.561 to a level comparable to those produced by a moderate-to-severe crash landing. Until a reasonable crash design condition is decided upon, including a specified crash acceleration pulse, we suggest that the longitudinal inertia force be raised to 20 to 25 g, and the forces about the other axes be similarly increased. The inertia forces specified in Table 1-1 of the U. S. Army Aviation Material Laboratories Technical Report 67-22, "Crash Survival Design Guide" could well serve as the basis for a civil aircraft crash design condition.

5. Crash Fire Protection

Fuel tanks and fuel systems should be designed to minimize the spillage of fuel in moderate to severe crashes. Materials used in

aircraft interiors should not support a self-sustained combustion, and should not give off toxic fumes. Further, fuel ignition should be minimized by requiring the circuit isolation of electrical energy sources in crashes.

In summary, the research conducted by the FAA and the U. S. Army has been informative. The time has come now to recognize the validity of the total accident and research findings in the field of aircraft occupant crash protection.

When you complete your evaluation of the Nader petition, we would appreciate a report on your findings and intended action.

Sincerely yours,

Original signed by
John H. Reed

John H. Reed
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

May 27, 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Thank you for your letter of April 24, 1981, further responding to National Transportation Safety Board Safety Recommendation A-72-56 issued May 16, 1972. This is one of two recommendations that pertain to the underwater recovery of cockpit voice recorders (CVR's) and flight data recorders (FDR's). Companion Recommendation A-72-57 was classified "Closed--Acceptable Action" on September 5, 1979.

In Safety Recommendation A-72-56 we recommended that the Federal Aviation Administration (FAA) initiate rulemaking action to require installation of underwater locating devices on new CVR's similar to those now required on FDR's by section 121.343 of the Federal Aviation Regulations (FAR). We are pleased to note that as a result of this recommendation, section 25.1457(g) and section 121.359(c) of the FAR have been revised to require underwater locating devices and reflective tape affixed to the CVR. We also note that air carrier operators have aggressively pursued the installation of underwater locating devices on CVR's. Safety Recommendation A-72-56 is now classified as "Closed--Acceptable Action."

We thank the FAA for actions taken.

Sincerely yours,

James B. King
Chairman

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 24, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-72-56 issued May 16, 1972, and supplements our letter of July 18, 1979. This also responds to your letter of August 27, 1980, in which you requested further information regarding our progress on this recommendation.

A-72-56. The Federal Aviation Administration initiate rulemaking action to require installation of underwater locating devices on new CVR's similar to those now required on FDR's by section 121.343 of the Federal Aviation Regulations.

FAA Comment. In our letter of July 18, 1979, we informed the Board that Federal Aviation Regulations (FAR), Part 25, Section 25.1457(g) and Part 121, Section 121.359(c), had been revised to require approved underwater locating devices and reflective tape affixed to the cockpit voice recorder. Copies of these revisions were provided the Board at that time.

This recommendation was then discussed at the NTSB/FAA quarterly meeting held on March 12, 1980. Members of the NTSB staff were informed that a large number of operators were already installing underwater locating devices on Cockpit Voice Recorders (CVR's), and we agreed to furnish further information regarding the extent to which this recommendation was being implemented.

Part 121, Section 121.359(c)(2)(iii) requires that CVR's must have an approved Underwater Locating Device (ULD) secured in such a manner that they are not likely to be separated during crash impact, unless the CVR's and the Flight Data Recorders (FDR) required by Part 121, Section 121.343, are installed adjacent to each other in such a manner that they are not likely to be separated during crash impact.

The ULD requirement was contained in Proposal No. 5-70, Notice No. 75-23, published in the Federal Register on May 27, 1975, (40 FR 23048). Interested parties participated in this part of the Airworthiness Review Program and Amendment 121-135 was adopted July 11, 1977, effective September 1, 1977. Operators were allowed 3 years to comply.

The words in the rules ". . . in such a manner that they are not likely to be separated during crash impact. . ." apply equally to structural integrity requirements of the physical relationship between the ULD's and the CVR's and between the FDR's and the CVR's. The FAA has information that air carrier operators are installing ULD's on CVR's rather than redesigning the FDR/CVR installation to assure that the units will not separate due to crash impact. In the Air India B-747 accident, the CVR was not installed in accordance with Part 121, Section 121.359(c)(2)(iii), nor was it so required. Our research indicates that approximately 2,750 U.S. air carrier aircraft are affected by Part 121, Section 121.359(c)(2)(iii). Fairchild, a company that enjoys about 75 percent of the cockpit voice recorder business, has shipped approximately 2,270 ULD's as of about 1 year ago. At that time, there were 270 additional orders for ULD's on hand at Fairchild. This company has been building CVR's with ULD's installed at a rate of 50 units per month for well over 1 year. Our information clearly reveals that air carrier operators have aggressively pursued installation of ULD's on CVR's.

Accordingly, we conclude that the changes to the Federal Aviation Regulations have met the intent of NTSB Safety Recommendation A-72-56, and the Federal Aviation Administration considers action on this safety recommendation completed.

Sincerely,

J. Lynn Helms
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to National Transportation Safety Board Safety Recommendation A-72-56 issued May 16, 1972. We recommended that:

> The Federal Aviation Administration (FAA) initiate rulemaking action to require installation of underwater locating devices on new cockpit voice recorders (CVR's) similar to those now required on flight data recorders (FDR's) by section 121.343 of the Federal Aviation Regulations.

This recommendation was discussed at the NTSB/FAA quarterly meeting held on March 12, 1980. Members of the NTSB staff were told that a large number of operators were already installing underwater locating devices on CVR's. They were also told that further information would be provided concerning the extent to which this recommendation is being implemented. In order to evaluate the status of this recommendation and update the public docket, we would appreciate being furnished with that information.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

July 18, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is to advise that Federal Aviation Administration actions with respect to National Transportation Safety Board Safety Recommendations A-72-56 and 57 have been completed.

A-72-56. The Federal Aviation Administration initiate rulemaking action to require installation of underwater locating devices on new CVR's similar to those now required by section 121.343 of the Federal Aviation Regulations.

A-72-57. The Federal Aviation Administration encourage operators of large aircraft to affix reflective tape to the cases of FDR's and CVR's until they can be equipped with underwater locating devices.

Action. Federal Aviation Regulations, sections 25.1457(g) and 121.359(c), were revised to require approved underwater locating devices and reflective tape affixed to the cockpit voice recorder.

We believe that these actions meet the intent of the recommendations.

Copies of the revisions are enclosed.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

2 Enclosures

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

9 MAR 1973

Honorable John H. Reed
Chairman, National Transportation Safety Board
Department of Transportation
Washington, D.C. 20591

Dear Mr. Chairman:

Thank you for your letter of 20 February 1973 which clarified the intent of the National Transportation Safety Board's Safety Recommendation A-72-56 concerning the installation of underwater locating devices on cockpit voice recorders (CVRs).

We are planning to issue an NPRM on this subject.

Sincerely,

(signed) Jack
J. H. Shaffer
Administrator

FEB 20 1973

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear Mr. Shaffer:

Thank you for your letter of January 30, 1973, from the Acting Administrator, concerning the National Transportation Safety Board's Safety Recommendation A-72-36, which was transmitted to you in our letter of August 24, 1972. We regret that you have encountered difficulty in processing an NPRM because of the inadvertent reference to "new" cockpit voice recorders (CVR's) in our recommendation.

As stated in our letter of August 24, 1972, we believe that every effort should be made to assure the availability of CVR tapes from aircraft involved in accidents as soon as possible after an accident occurs. For this reason, we would like to have underwater locating devices on all CVR's as early as it is feasible to have them installed. We agree with the proposal in your letter of September 14, 1972, for FAA to issue an NPRM requiring installation of underwater locating devices on CVR's similar to those now required on flight data recorders by Section 121.343 of the FAR. We believe this should apply to CVR's presently installed in aircraft, as well as those manufactured in the future.

We appreciate very much your consideration of our Safety Recommendation.

Sincerely yours,

Original signed by
John H. Reed

John H. Reed
Chairman

30 JAN 1973

Honorable John H. Reed
Chairman, National Transportation Safety Board
Department of Transportation
Washington, D.C. 20591

Dear Mr. Chairman:

Our response to your correspondence of 24 August 1972 was based on our understanding that the NTSB Safety Recommendation A-72-56 requested the agency to initiate rulemaking action to require the installation of underwater locating devices on newly manufactured CVRs.

Therefore, preparatory to the issuance of the NPRM, our project manager on 11 and 18 December 1972 discussed A-72-56 with the Bureau of Aviation Safety personnel. The discussion was centered around the word "new" as used in the Bureau's recommendation; and the need to establish in the NPRM the date after which all subsequent newly manufactured CVRs would be required to have the locating device installed. As a result of these discussions, the Bureau personnel requested we delay initiating the NPRM, as they did not believe the proposed regulation would meet the needs of the Bureau.

Your personnel stated it was the intent of the Bureau recommendation to require the locator device on CVRs presently installed in aircraft as well as those CVRs manufactured in the future.

We, therefore, are withholding regulatory action on the Safety Recommendation until we receive further clarification from you.

If it was not the intent of A-72-56 to require installation of the locating device on only newly manufactured CVRs, you may wish to withdraw the Safety Recommendation.

Sincerely,

Original signed by
G. S. Moore
ACTING Administrator

2 Enclosures:
Chairman Reed's correspondence of 24 August 1972
Our response of 14 September 1972 to correspondence of 24 August 1972

14 SEP 1972

Honorable John H. Reed
Chairman, National Transportation
Safety Board
Department of Transportation
Washington, D. C. 20591

Dear Mr. Chairman:

This is in response to your letter of 24 August 1972, requesting reconsideration of our position as stated to you in our letter of 19 May 1972, regarding Safety Recommendations A-72-56 and A-72-57. These recommendations have to do with an underwater locating device (pinger) and reflective tape to aid in locating flight data recorders (FDRs) and cockpit voice recorders (CVRs) when they are submerged or lost following an accident.

We are aware of the difficulty encountered in recovering the CVR following the North Central Airlines/Air Wisconsin collision over Lake Winnebago on 29 June 1972.

As a result, we are going to issue an NPRM for installation of underwater locating devices on CVRs similar to those now required on FDRs by section 121.343 of the FARs.

We will, also, take additional steps to encourage operators of large aircraft to affix reflective tape to the cases of FDRs and CVRs until they are equipped with underwater locating devices.

Sincerely,

SIGNED BY
J. H. SHAFFER
ADMINISTRATOR

DEPARTMENT OF TRANSPORTATION
NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20591

August 24, 1972

OFFICE OF
THE CHAIRMAN

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear ~~Mr. Shaffer~~ Jack:

The National Transportation Safety Board has reviewed your response of May 19 to its letter of May 8, 1972, on the subject of its recommendations concerning cockpit voice recorders (CVR) and flight data recorders (FDR). We still believe that a locating device for each recorder is warranted at this time.

These recorders have proven to be such valuable devices for accident investigation and accident prevention that the Safety Board believes every effort should be made to assure the availability of the recorder tapes from aircraft involved in accidents as soon as possible after an accident occurs. The use of such relatively inexpensive and easy-to-install devices as the underwater "pinger" and reflective tape should not be delayed any longer than necessary. Their effectiveness has been proven in so many applications that it does not seem necessary to wait for an evaluation of the devices to be required on flight recorders in 1974.

In regard to your comment that the CVR and FDR are usually mounted on the same shelf, the use of such an installation does not assure that the two recorders will remain close together when there is extensive water breakup of the aircraft structure. Our experience has shown that components mounted adjacent to each other in the aircraft may be widely separated when the wreckage comes to rest after a catastrophic accident. Also, when wreckage is located on ocean or lake bottoms, some components may be buried in silt or mud, or visibility may be so poor that finding one recorder may not be of much help in locating the other, even if they are close together. Our attempt to recover the CVR from the North Central Airlines/Air Wisconsin collision accident which occurred near Appleton, Wisconsin, on June 29, 1972, is a good example of the expense and delay that can be encountered in underwater searches. Although the FDR and the structure to which the CVR was attached were found in Lake Winnebago soon after the accident occurred, the CVR was not found during the wreckage recovery operation.

In regard to the need for more than one underwater locating device, our views were stated in a letter (copy enclosed) dated October 29, 1965, from the Director of the Civil Aeronautics Board's Bureau of Safety to the Director of Federal Aviation Agency's Flight Standards Service. As indicated above, subsequent experience in a number of accidents has reinforced the validity of this position that "pingers" should be installed on both recorders.

We support the requirement to incorporate reflective stripping in technical standard orders. This presumably will bring about compliance with the airlines' informal agreement to provide such reflective stripping on the exterior cover of FDR's and CVR's. At the present time, however, some airlines are not voluntarily complying with that agreement. The information available to us indicates that approximately 14 airlines have plans for placing reflective tape on both recorders and about four other airlines are putting such tape on CVR's or plan to do so in the near future. It appears that a reminder addressed to the airlines now, encouraging them to comply with the agreement might be appropriate and timely.

Thus, for the reasons outlined above, the Safety Board requests your reconsideration of the following recommendations as stated in its letter of May 16, 1972:

A-72-56 The Federal Aviation Administration initiate rulemaking action to require installation of underwater locating devices on new CVR's similar to those now required on FDR's by section 121.343 of the Federal Aviation Regulations.

A-72-57 The Federal Aviation Administration encourage operators of large aircraft to affix reflective tape to the cases of FDR's and CVR's until they can be equipped with underwater locating devices.

Sincerely yours,

John

John H. Reed
Chairman

Enclosure

OCT 29 1965

Mr. George S. Moore
Director
Flight Standards Service
Federal Aviation Agency
Washington, D. C. 20553

Dear Mr. Moore:

Lack of success to date in very extensive efforts to recover the flight recorder installed in United Air Lines Boeing 727, N7036U, which crashed in Lake Michigan on August 16, 1965, directs attention again to the need for improved means of locating submerged wreckage and recovering the recorder data.

A very helpful measure toward this end was pointed out to the Steering Committee on Airline Sabotage by its Study Group on Post Accident Detectability. The June 25, 1962, report of this group contained the recommendation that sonar "Pingers" be required in all flight recorders and at various points in the structure of all air carrier aircraft in overwater operations.

This device is a small, inexpensive, lightweight, sound transmitter powered by a self-contained battery which is actuated by water immersion. The only maintenance required is a simple battery change once each year. It is currently used by the Langley Research Center of NASA for the rapid location and recovery of objects underwater in connection with missile research. Various types of sonar gear can be used to home in directly on the transmitter.

In addition to the accident mentioned above, this device would have been very helpful in locating the recorder in four previous accidents and in two of the cases would have assisted in locating the wreckage with a minimum of delay and expense. These were the American Airlines Boeing 707 at Montauk Point, the American Airlines 707 in Jamaica Bay, the West Coast Airlines Fairchild F-27 in the Great Salt Lake, and the Eastern Air Lines DC-8 in Lake Pontchartrain.

In view of the above, it is recommended that additional consideration be given to requiring the installation of sound transmitters. Based on the accident records it appears that they should be installed in the flight recorders, in the voice recorders, and at

various points in the structure of all air carrier aircraft. The device should be capable of self-actuation on immersion in either fresh or salt water. It should emit a signal with a range of at least 3000 yards and have an operating life of at least 150 hours.

Should additional information be desired, personnel of our Engineering Division will be available to give assistance.

Sincerely yours,

Original Signed By
B. R. Allen

B. R. Allen
Director, Bureau of Safety

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

19 MAY 1972

Honorable John H. Reed
Chairman, National Transportation
Safety Board
Department of Transportation
Washington, D. C. 20591

Dear Mr. Chairman:

This responds to safety recommendations A 72-56 and 57 concerning cockpit voice recorders (CVR). We have carefully reviewed these recommendations and have the following comments to offer:

Recommendation Number 1.

We believe that any action to require another underwater locating device should be deferred until we have acquired sufficient operational experience from the device that is required to be installed with the flight recorder by 18 March 1974.

Federal Aviation Regulations Sections 25.1457 and 25.1459 require that the CVR and the flight data recorder (FDR) both be installed as far aft as practicable. Usually these recorders are installed on the same shelf and often side by side. Therefore, it is difficult to understand the advantages that would be derived by having two underwater locating devices placed in close proximity to each other.

A joint meeting with Federal Aviation Administration (FAA)/Air Transport Association/NTSB representatives in attendance concerning flight recorders was held on 25 June 1969. At this meeting the FAA agreed, and the NTSB representatives did not object, that only one underwater locating device per airplane would be required.

Recommendation Number 2.

On 16 March 1971 a joint government/industry meeting was convened to discuss, among other things, reflective stripping on the CVR cover. At this meeting, with a NTSB representative in attendance, the airlines

agreed to provide reflective stripping on the exterior cover of the CVR. To the best of our knowledge, the airlines are accomplishing this objective on the CVRs as well as the FDRs. Furthermore, as the appropriate technical standards orders (TSOs) are being developed or revised, the requirement for reflective stripping is being incorporared in the TSO.

Sincerely,

ORIGINAL SIGNED BY
J. H. SHAFFER
ADMINISTRATOR

UNITED STATES OF AMERICA

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C.

ISSUED: May 16, 1972

Adopted by the NATIONAL TRANSPORTATION SAFETY BOARD
at its office in Washington, D. C.
on the 16th day of February 1972

FORWARDED TO:
Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATIONS A-72-56 & 57

The National Transportation Safety Board's letters to you, dated June 1, 1970, and July 30, 1970, made several recommendations regarding cockpit voice recorder (CVR) installations.

One of these recommendations concerned underwater recovery of cockpit voice recorders. Following our initial recommendations, engineers from the Safety Board and the Federal Aviation Administration met with the officials of the Navy diving school to determine the best method of locating CVR and the flight data recorders (FDR). They suggested that the installation of an acoustic beacon (pinger) on the units would greatly facilitate underwater recovery. They further suggested that if acoustic beacons could not be installed, conspicuity markings should be put on the case even though it had been their experience that conspicuity markings would not appreciably improve the chances of underwater recovery unless visibility was good.

As the result of our conversations with Navy diving school and Naval Research Laboratory personnel, and our experience in attempting to recover recorders from underwater and mud, the Safety Board recommends that:

1. The Federal Aviation Administration initiate rulemaking action to require installation of underwater locating devices on new CVR's similar to those now required on FDR's by section 121.343 of the Federal Aviation Regulations.

2. The Federal Aviation Administration encourage operators of large aircraft to affix reflective tape to the cases of FDR's and CVR's until they can be equipped with underwater locating devices.

If we may be of further assistance, please let us know.

These recommendations will be released to the public on the issue date shown above. No public dissemination of the contents of this document should be made prior to that date.

Reed, Chairman; Laurel, McAdams, Thayer, and Burgess, Members, concurred in the above recommendations.

John H. Reed

By: John H. Reed
Chairman

73708

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SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
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FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

April 1, 1981

OFFICE OF THE ADMINISTRATOR

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-74-55 issued July 10, 1974, and supplements our letter of October 2, 1978. This also responds to your letter of August 19, 1980, in which you requested a progress report regarding this recommendation.

A-74-55.

Continue to install VASI's on all ILS runways, but with the first priority being assigned to runways where the glide slope is unusable below DH and to those runways used by air carrier aircraft.

FAA Comment.

Our policy of assigning the highest priority to installation of Visual Approach Slope Indicators (VASI) at nonprecision approach runways remains unchanged.

In our letter of October 2, 1978, we stated that the Federal Aviation Administration (FAA) had installed 526 VASI's on runways used by air carriers. In addition, 87 VASI's had been installed on ILS runways. As of June 30, 1980, the FAA had installed an additional 297 VASI's on runways used by air carriers for a total of 823. The FAA has also installed 105 VASI's on ILS runways for a total of 402 VASI's installed since our last report in 1978.

Obviously, this is an ongoing FAA F&E program. In view of our continuing efforts and significant progress in this area, we do not believe these periodic progress reports any longer serve the common interest of either the NTSB or the FAA. Accordingly, the FAA considers action completed on Safety Recommendation A-74-55 and we encourage the Board to now classify this recommendation in a "closed" status.

Sincerely,

Charles E. Weithoner
Acting Administrator

Office of
Chairman

National Transportation Safety Board

Washington, D.C. 20594

August 19, 1980

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to National Transportation Safety Board Safety Recommendation A-74-55 issued July 10, 1974. This recommendation pertains to the installation of visual approach slope indicators. The Federal Aviation Administration's response of October 2, 1978, indicated significant progress toward fulfillment of the recommendation. In order to evaluate its present status and update the public docket, we request a further progress report.

Sincerely yours,

for James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

October 2, 1978

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to your letter of August 4 which requested information concerning the progress made toward fulfillment of NTSB Safety Recommendation A-74-55.

Our policy of assigning the highest priority for Visual Approach Slope Indicators (VASI) to nonprecision runways is unchanged. However, we have made significant progress toward fulfillment of the recommendation.

At the present time there are 1,013 VASI installations on airports certificated for either full or limited air carrier operations. The FAA operates and maintains 526 of these 1,013 VASI's on runways used by air carriers. In addition, we have installed VASI systems on 87 ILS runways, 5 of which have glide slope restrictions.

We trust that this is responsive to your request.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

August 4, 1978

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

This is to request the status of National Transportation Safety Board Recommendation A-74-55, issued July 10, 1974. This recommendation pertains to the installation of visual approach slope indicators (VASI) on all instrument landing system (ILS) runways with first priority given to runways where the glide slope is unusable below decision height, and to those runways used by air carrier aircraft.

The Federal Aviation Administration's (FAA) response of August 8, 1974, indicated that the FAA agreed in principle with the recommendation, but was giving priority to installing VASI on non-precision runways. Through staff sources we have been advised of a significant but budget-restricted VASI installation program. Although we have been made aware of the budget constraints, we would appreciate being informed of the progress made towards the fulfillment of this recommendation.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

AUG 8 1974

Honorable John H. Reed
Chairman, National Transportation Safety Board
Department of Transportation
Washington, D. C. 20591

Dear Mr. Chairman:

We have reviewed the Board's proposal to provide VASIs on all ILS runways with priority for those locations where the glide path is out of tolerance below the decision height.

While we agree in principle with the recommendation, we have an action pending to fund VASIs and marker beacons for installation first on all nonprecision approach runways. This will enable pilots to adjust their flight path to establish a stabilized rate of descent when conducting nonprecision approaches to those runways where no electronic glide slope is installed. Accordingly, the provision of vertical guidance on nonprecision runways will take priority over the installation of VASIs on ILS runways.

Sincerely,

Alexander P. Butterfield
Alexander P. Butterfield
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 10, 1974

Forwarded to:

Honorable Alexander P. Butterfield
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-74-55

On October 28, 1973, Piedmont Air Lines Flight 20, a B-737, was involved in an accident at the Greensboro-High Point-Winston Salem Regional Airport, at Greensboro, North Carolina. The flight was attempting a precision approach (ILS) to runway 14. The accident occurred during darkness, a heavy rainshower, and restricted visibility.

Two similar accidents have also occurred recently. On November 27, 1973, a Delta Air Lines DC-9-32 was involved in an accident at Chattanooga, Tennessee, and on December 17, 1973, an Iberian DC-10-30 was involved in an accident at Logan International Airport, in Boston, Massachusetts. Both aircraft were making precision approaches during meteorological conditions that included low ceilings and limited visibility. The investigations of these accidents revealed an area in the approach-to-landing phase of flight that can be made safer by additional approach guidance.

Although vertical guidance was provided in each case by an electronic glide slope, no visual approach slope indicator (VASI) system was installed for any of the approaches. Therefore, the crew had to rely only on visual cues during the final critical stage of the approach. The Safety Board realizes that a VASI is not required; however, the Board believes that the installation of a VASI in conjunction with a full ILS should not be considered a duplication of equipment, as these accidents indicate that additional vertical guidance is needed to complement the electronic glide slope.

Honorable Alexander P. Butterfield (2)

The installation of a VASI on a precision approach runway would not replace the glide slope as the primary means of vertical guidance, nor would it change the intent of 14 CFR 91.117 regarding descent below decision height (DH). A VASI would, however, do much to enhance the safety factor by allowing the pilot to transfer to the visual portion of the approach and still retain a display of his approach path, since during periods of low visibility, the visual cues available from the approach lights and the approach end of the runway may be inadequate.

In replies to previous NTSB recommendations concerning altitude and ground warning systems, the Administrator apparently agreed in stating: "The VASI would provide vertical guidance at normal descent rates for the visual segments of the approach. This result would be a greater degree of altitude awareness through the procedure."

The captain of the Delta DC-9 stated that he believed the approach was normal until just before impact, when his sight picture suddenly flattened. Possibly, he was experiencing an optical illusion caused by the heavy rain on the aircraft windshield. Had there been a VASI available, the captain would have been warned that the aircraft was descending below glidepath.

Several major airports have been certificated which have precision approaches where the glide slope is unusable below DH. Logan International Airport and Los Angeles International Airport are only two of these airports. If a VASI were available for approaches of this type, more positive vertical guidance would be available from DH to landing. In addition, VASI could also be used when the approach becomes visual before the aircraft reaches DH. The pilot who knows that the glide slope will exceed tolerances below DH should integrate the VASI into his normal scan pattern and use the VASI to monitor the final stages of the approach.

The Safety Board believes the VASI can be a valuable supplement to any ILS approach, even under minimum weather conditions, and therefore recommends that the Federal Aviation Administration:

> Continue to install VASI's on all ILS runways, but with the first priority being assigned to runways where the glide slope is unusable below DH and to those runways used by air carrier aircraft.

REED, Chairman, McADAMS, THAYER, and BURGESS, Members, concurred in the above recommendation. HALEY, Member, was absent, not voting.

John H. Reed

By: John H. Reed
Chairman

U.S. Department of Transportation
Federal Aviation Administration

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

June 10, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-74-105, and A-74-107 through A-74-112 issued January 5, 1975. This also responds to your letter of March 18, 1981, in which you requested a report of the Federal Aviation Administration's (FAA) actions on these recommendations. We note that A-74-106, -113, and -114 were closed previously by official Board action.

A-74-105. Require that air carriers report all emergency evacuation slide deployments, failures, and malfunctions to the FAA.

FAA Comment. A Notice of Proposed Rulemaking (NPRM) (Operations Review Program: Notice No. 11) has been issued and published in the Federal Register, Vol. 46, No. 12, Monday, January 19, 1981. This NPRM proposes to add a paragraph to 121.703(a) to require each certificate holder to ". . . Report the occurrence or detection of each failure, malfunction, or defect concerning -- (18) Emergency Escape Slides . . . ." A copy of this document is enclosed. We will notify the Board after making our final rulemaking decision.

A-74-107. Amend 14 CFR 25.809 to require that the length of the emergency evacuation slides be such that the angle with ground renders the slide safe and usable after collapse of one leg, or more, of the landing gear, and amend 14 CFR 121.310 to require that these new slides be installed after a reasonable date.

FAA Comment. A final rule (Operations Review Program: Amendment No. 10; Airworthiness, Equipment, and Operating Rules) has been issued amending § 25.809(f)(1)(iii) as published in the Federal Register (44 FR 11323, October 25, 1979). A copy of the final rule is enclosed. The second portion of this recommendation ". . . amend 14 CFR 121.310 . . ." was originally included in the Operations Review Program mentioned above but was removed from further consideration by the FAA by Operations Review Program Notice No. 10 (43 FR 37958, August 24, 1978). As explained in Notice 10, our analysis established that requiring the retrofit of existing

airplanes that do not comply with the revised § 25.809(f)(1)(iii) requirements is unwarranted because the burdens associated with making these changes are not commensurate with the anticipated increase in safety. Accordingly, the FAA considers action on Safety Recommendation A-74-107 completed.

A-74-108. Amend 14 CFR 121.310 to require, after a reasonable date, that emergency evacuation slides on all floor-level exits be automatically inflated upon deployment.

FAA Comment. This recommendation is also addressed in Operations Review Program: Notice No. 11, Federal Register, January 19, 1981. We believe that current regulations provide an acceptable level of safety and the recommended change does not justify the significant economic burden that would result. The public was advised of the withdrawal of this proposal in the Federal Register, Vol. 46, No. 12, dated January 19, 1981. Accordingly, this proposal was removed from consideration and the FAA intends to take no further action on Safety Recommendation A-74-108.

A-74-109. Amend 14 CFR 25.812 to require that exterior emergency lighting be activated automatically when exits are opened in the emergency mode, and amend 14 CFR 121.310 to require such automatic activation after some reasonable date.

FAA Comment. This recommendation is also addressed in the Final Rule, Operations Review Program: Amendment No. 10, Federal Register, October 25, 1979. The FAA had determined that safety would not be improved as a result of the recommended change to 25.812 and that the recommended change to § 121.310(h)(1)(iii) would impose financial burdens on the public not commensurate with the increase in safety. As a consequence, the proposed changes to §§ 25.812 and 121.310(h)(1)(iii) were withdrawn and the public was advised of this withdrawal in the Federal Register, (44 FR 61323 dated October 25, 1979). Accordingly, the FAA intends to take no further action on Safety Recommendation A-74-109.

A-74-110. Require that the air carriers designate the flight attendant(s) who will be responsible for use of the megaphone(s) during an evacuation, and relocate the megaphone(s) so they are within easy reach of that flight attendant(s)' seat. Consideration should be given to the installation of new, light and compact megaphones to facilitate stowage and use.

FAA Comment. Megaphones are already required by § 121.309(f)(2) to be readily accessible from normally located flight attendant seating. A proposal that would have revised § 131.309(f), to require that the certificate holder designate the flight attendant responsible for the use of the megaphone during an emergency evacuation has been withdrawn from Operations Review Program Notice No. 11. This proposal will not receive further consideration because it is impractical for the certificate holder to designate the flight attendant responsible for using the portable megaphones when the need exists. All flight attendants are trained in the use of megaphones and are expected to be proficient in their operation in case

of an emergency. The public was advised of the withdrawal of this proposal in the Federal Register, Vol. 46, No. 12, dated January 19, 1981. Accordingly, the FAA intends to take no further action on Safety Recommendation A-74-110.

A-74-111. Amend 14 CFR 121.318 to require after a reasonable date, that public address systems can be capable of operating on a power source independent of the main aircraft power supply.

FAA Comment. Safety Recommendation A-74-111 is addressed in Operations Review Program: Notice No. 11, Federal Register, January 19, 1981.

A-74-112. Require that air carrier passengers be alerted, during pre-takeoff briefings, of the need to familiarize themselves with the procedures involved in the operation of emergency exits.

FAA Comment. A proposal to amend § 121.571 in accordance with this recommendation has been withdrawn from Operations Review Program Notice No. 11. This proposal will receive no further consideration because the current passenger briefings and information on the printed briefing cards already convey information regarding the operation of emergency exits. Dissemination of this information is being emphasized during crewmember training programs and during passenger briefing that is required by § 121.571. Additionally, this information is clearly posted at each emergency exit. The public was advised of the withdrawal of this proposal in the Federal Register, Vol. 46, No. 12, dated January 19, 1981.

The FAA believes the various actions outlined in this letter are responsive to Safety Recommendations A-74-105 and A-74-107 through -112. Accordingly, we consider action completed in those cases where rulemaking is finalized or the proposal has been withdrawn or action otherwise terminated. For those actions still in a proposed state of rulemaking, we will keep the Board informed of the progress as our Operations Review Program continues.

Sincerely,

J. Lynn Helms
Administrator

Enclosures

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

March 18, 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

As a result of a special study on the "Safety Aspects of Emergency Evacuations from Air Carrier Aircraft," on January 5, 1975, the National Transportation Safety Board forwarded Safety Recommendations A-74-105 through A-74-114 to the Federal Aviation Administration (FAA). Of these ten recommendations, A-74-105, 107, 108, 109, 110, 111, and 112 remain in an open status awaiting further resolution. The FAA's letters of March 26, 1980, and August 6, 1980, indicated that the FAA would review the status of these recommendations and advise the Safety Board shortly.

We are aware that the FAA has taken several actions to resolve these recommendations. In order to evaluate their progress and update the public docket, we again request a written report of further actions taken.

Sincerely yours,

James B. King

James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of
Chairman

JUL 30 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

By letter dated March 18, 1980, we requested an updated status report on National Transportation Safety Board Safety Recommendations A-74-105, 107, 108, 109, 110, 111, and 112. The Federal Aviation Administration (FAA) acknowledgement letter of March 26, 1980, indicated that the FAA would review the status of these recommendations and advise the Safety Board shortly.

We are anxious to resolve these old recommendations, and we would appreciate being informed as to when we might expect the FAA's review.

Sincerely yours,

James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

March 18, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to the National Transportation Safety Board's Special Study, "Safety Aspects of Emergency Evacuations from Air Carrier Aircraft." As a result of this study, the Safety Board forwarded Safety Recommendations A-74-105 through A-74-114 on January 5, 1975, to the Federal Aviation Administration (FAA). Of these ten recommendations, A-74-106, A-74-113 and A-74-114 are in a "CLOSED--ACCEPTABLE ACTION" status. However, the remaining seven are maintained in an open status awaiting further responsive action by the FAA.

We are aware that the FAA has taken several actions to resolve these recommendations. In order to evaluate their progress and update the public docket, we would appreciate a written report of further responsive actions taken.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

August 18, 1977

Honorable Webster B. Todd, Jr.
Chairman, National Transportation Safety Board
800 Independence Avenue, SW
Washington, DC 20594

Dear Mr. Chairman:

This supplements our May 9, 1975, letter and responds to your letter dated July 28, requesting a written status report on recommendations A-74-105 thru 114.

A-74-105. Project No. AFS-230-123 was established in June 1976 to review and revise, as necessary, the reporting requirements of FAR's 121.703/705 and 127.313. We are currently evaluating numerous comments from the regions and data from our Maintenance Analysis Center to assist in justifying a rule change. The estimated completion date for this work is December 1977.

A-74-106. A training course on emergency evacuation slide systems commenced on May 5, 1975, at PICO, San Francisco, California.

A-74-108. This recommendation was considered in the First Biennial Operations Review. The proposal will be included in Operations Review Notice #10 which will be published by December 1.

A-74-110. The subject of this recommendation was proposed in the Biennial Operations Review as Proposal #427. The Committee removed the proposal from consideration. Present airline practices make it unnecessary to designate the flight attendant responsible for using the megaphone. Further, it is not considered necessary to tell carriers they must use new, light and compact megaphones. We plan no further action at this time.

A-74-112. This recommendation was transferred to the Biennial Operations Review as Proposal #586. The Committee recommended a Notice of Proposed Rule Making (NPRM). NPRM 77-12 was published in the Federal Register on July 21.

A-74-113. Advisory Circular, AC-121-24, Passenger Safety Information Briefing and Briefing Cards, was signed and forwarded to the printer for publication and distribution on June 23.

A-74-107, 109, 111 and 114. These recommendations were transferred to the Biennial Operations Review as Proposals # 3/429, 4/434, 452 and 513/514, respectively. The proposals are being evaluated for consideration for rulemaking action. Due to the intricacies of the rulemaking process, we are unable to give a reasonable estimate of a date for completion of the evaluations. However, the results of the evaluations will be published in the Federal Register.

Sincerely,

Charles O. Cary
Acting Administrator

National Transportation Safety Board

Washington, D.C. 20594

July 28, 1977

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Dear Mr. Bond:

On January 5, 1975, as a result of an NTSB Special Study of "Safety Aspects of Emergency Evacuations from Air Carrier Aircraft," we submitted ten recommendations to the FAA, A-74-105 through 114. These recommendations have been kept in an open status pending confirmation of FAA's final action.

The FAA's last letter to the Safety Board in response to these recommendations is dated May 9, 1975. We are aware that the FAA has since taken several actions to resolve these recommendations. However, to better evaluate the progress of these recommendations and to bring the public docket up to date, we would appreciate a written status report.

Sincerely,

Webster B. Todd, Jr.
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

MAY 9 1975

Honorable John H. Reed
Chairman, National Transportation Safety Board
800 Independence Ave., S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This supplements our January 29 response to Safety Recommendations A-74-105 thru 114.

1. A rulemaking project (No. FS-74-47-R) is underway which will revise FAR 121.703 "Mechanical Reliability Reports." Reports of malfunctions or failures of all emergency and survival equipment will be required.

2. FAR 121.309(b) states, "Each item of emergency and flotation equipment listed in this section and in paragraphs 121.310, 121.339, 121.340" and .309(b)(1) continues: "Must be inspected regularly in accordance with inspection periods established in the operations specifications to ensure its condition for continued serviceability and immediate readiness to perform its intended emergency purposes."

FAR 121.310 requires the installation of emergency evacuation equipment. In addition to the operators' responsibilities for the maintenance of the equipment, our inspectors are charged with similar responsibilities as they relate to each operator's total maintenance and inspection program. We cannot exert all of our efforts toward the surveillance of any one particular area or system. Our surveillance is normally overall with special emphasis directed to specific areas as needs arise.

For your information, we have contracted for special training for our maintenance inspectors on the maintenance requirements, operation and inspection of emergency evacuation equipment.

3. While the requirements contained in FAR 37.175 currently provide that evacuation slides be safe and useable with the collapse of any one or two landing gear legs, we believe that these should be reflected in FAR 25.809 and 121.310. Accordingly, we will initiate rulemaking action to amend FAR 25 and 121 which will cover the usability of evacuation slides during adverse gear collapse conditions.

4. FAR Part 25 presently requires each floor level exit more than six feet above ground to be equipped with a slide which automatically deploys and inflates when the exit is opened. FAR 121 requires automatic slides for exits in airplanes currently in service with the exception of passenger entry and service doors. Automatic deployment at opening is required for these doors, but inflation can be accomplished by pulling an inflation lanyard. The fully automatic slide has not been developed to the extent that the time saving for evacuation would justify retrofitting.

5. We agree with this recommendation and will initiate a rulemaking action under FAR Part 25 to require that exterior emergency lighting be activated when the assist means are erected. We will initiate rulemaking action to amend FAR 121.310, as appropriate, when FAR Part 25 has been amended.

6. We agree that air carriers should designate the flight attendants who will be responsible for use of the megaphone(s) during evacuations and relocate the megaphones. We are considering the means by which this can be implemented.

The present rule is within the scope and intent and provides the authority. We will implement the requirement in the near future and advise.

7. We will establish a project to amend FAR 121.318, as appropriate, when the proposed revisions to FAR Part 25 have been adopted.

8. We concur and will issue an air carrier operations bulletin.

9. An advisory circular is being prepared which will publicize the FARs pertaining to cabin and passenger safety in air carrier operations.

10. A regulatory project on cabin attendant training has been initiated. It will include the items in the recommendation.

Sincerely,

James E. Dow

/James E. Dow
Acting Administrator

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

JAN 29 1975

Honorable John H. Reed
Chairman, National Transportation Safety Board
Department of Transportation
Washington, D. C. 20591

Dear Mr. Chairman:

This is to acknowledge receipt of Safety Recommendations A-74-105 through 114.

We are aware of the continuing requirement for emphasis on aircraft cabin safety. During the past year, we have been working closely with the Association of Flight Attendants to determine what kind of equipment and training they believe is needed. We directed all regions to conduct special inspections on cabin safety. A Notice of Proposed Rule Making for the transportation of handicapped persons has been issued. Numerous air carrier operations bulletins pertaining to cabin safety have been issued and a regulatory project to increase training requirements for flight attendants is being developed.

We will continue to stress cabin safety and welcome constructive recommendations for solutions to problems associated with emergency evacuation.

We will respond to the recommendations, in detail, as soon as our review and study of them have been completed.

Sincerely,

Alexander P. Butterfield
Alexander P. Butterfield
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

FOR RELEASE: 6:30 P.M., JAN. 5, 1975 ISSUED: January 5, 1975

Forwarded to:

Honorable Alexander P. Butterfield
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-74-105 thru 114

The National Transportation Safety Board is concerned about the number of passengers who are injured or killed during emergency evacuations from air carrier aircraft. As a result, the Safety Board has conducted a study, "Safety Aspects of Evacuations from Air Carrier Aircraft," which identifies and assesses factors that most often affect emergency evacuations. The study revealed several areas in which actions are needed to make emergency evacuations safer for passengers.

During the study, the Safety Board reexamined air carrier accidents during which emergency evacuations took place and examined the Federal Aviation Administration's incident files. From these sources, 10 recent air carrier accidents were selected and discussed in the study, because they best exemplified the most common circumstances encountered during evacuations following "survivable" aircraft accidents.

The Board's study revealed several deficiencies which have occurred repeatedly and have had a detrimental effect on the success of emergency evacuations:

Evacuation Slides--. Three problem areas were found with evacuation slides. First, because deployments of evacuation slides and their failures to function properly are not reported, the reliability of evacuation slide systems cannot be evaluated. Numerous slide failures were identified in the study; however, because the total number of failures cannot be determined, the total significance of the failures identified cannot be established. Second, manually inflated evacuation slides required more time to make an exit usable than fully automatic slide

systems. In some of the accidents examined, passengers were ready to deplane, or were deplaning, before slides were inflated. Third, it was found that nose-high or tail-high attitudes of wide-bodied aircraft may render some exits unusable, because of the nearly vertical position of the slides. In two accidents studied, slides were unsafe and unusable because of the attitude of the aircraft.

Exterior Emergency Lighting--. Evacuations during darkness require adequate external illumination to reduce the number of injuries. Current exterior lighting systems are activated when main aircraft power is interrupted. During two nighttime accidents studied, the exterior lighting systems were not activated because the aircraft engines were operating during the evacuations; passengers were injured as a result.

Emergency Communications--. Currently, the only type of emergency evacuation communications equipment required by regulation is the megaphone. Megaphones were not used to initiate or to conduct evacuations in any of the accidents or incidents studied. The storage location of megaphones does not place them in easy reach for flight attendants at their evacuation duty stations.

Although the regulations do not require public address systems for emergency communications, these systems are often used to initiate emergency evacuations. However, since the public address systems are not always connected to the emergency electrical supply, they are not always usable when aircraft power is interrupted. The study revealed that a concise evacuation order is essential, and reliable communication during the evacuation is important.

Passenger Safety Information--. While analyzing the 10 specific accidents and other accident information, shortcomings in regulations and procedures for conveying safety information to passengers of air carrier aircraft were revealed. For example, following an evacuation, passengers frequently suggest the need for more safety information, yet they could not recall having heard the pretakeoff briefing, nor had they read the safety information card. These reports are substantiated by Safety Board investigators' observations that passengers generally are not attentive to pretakeoff briefings nor do they read the safety information cards. Since these two sources are generally the only means by which passengers can become acquainted with emergency information, proper presentation of such information is of the utmost importance. Furthermore, the successes of two evacuations which were prebriefed support the conclusion that more adequate safety information must be conveyed to the air carrier passenger and his understanding assured.

Crewmember Emergency Training--. The performance of the crewmembers during the evacuation has a great potential for causing problems. During several accidents examined, crewmembers either lacked knowledge of the aircraft emergency evacuation systems or failed to follow established procedures. These cases suggest that current crewmember emergency training may be inadequate. The Safety Board has found that the training techniques used by some airlines for crewmember emergency evacuation training rely more on audio-visual demonstrations than on actual "hands-on" training.

In view of the above, the National Transportation Safety Board recommends that the Federal Aviation Administration:

1. Require that air carriers report all emergency evacuation slide deployments, failures, and malfunctions to the FAA.

2. Develop a maintenance surveillance program to insure greater reliability of emergency evacuation slide systems.

3. Amend 14 CFR 25.809 to require that the length of the emergency evacuation slides be such that the angle with the ground renders the slide safe and usable after collapse of one leg, or more, of the landing gear, and amend 14 CFR 121.310 to require that these new slides be installed after a reasonable date.

4. Amend 14 CFR 121.310 to require, after a reasonable date, that emergency evacuation slides on all floor-level exits be automatically inflated upon deployment.

5. Amend 14 CFR 25.812 to require that exterior emergency lighting be activated automatically when exits are opened in the emergency mode, and amend 14 CFR 121.310 to require such automatic activation after some reasonable date.

6. Require that the air carriers designate the flight attendant(s) who will be responsible for use of the megaphone(s) during an evacuation, and relocate the megaphone(s) so they are within easy reach of that flight attendant(s)' seat. Consideration should be given to the installation of new, light and compact megaphones to facilitate stowage and use.

7. Amend 14 CFR 121.318 to require after a reasonable date, that public address systems be capable of operating on a power source independent of the main aircraft power supply.

8. Require that air carrier passengers be alerted, during pretakeoff briefings, of the need to familiarize themselves with the procedures involved in the operation of emergency exits.

9. Issue an Advisory Circular which would provide standardized guidance to the air transport industry on effective methods and techniques for conveying safety information to passengers.

10. Amend 14 CFR 121.417(c)(4) to eliminate the provision which permits carriers to use demonstrations alone to train crewmembers for certain emergency situations, thus requiring performance of drills in the operation and use of emergency exits.

Representatives of our Bureau of Aviation Safety will be available for consultation in connection with this matter if desired.

REED, Chairman, McADAMS, THAYER, and BURGESS, Members, concurred in the above recommendations. HALEY, Member, did not participate.

John H. Reed

By John H. Reed
Chairman

THESE RECOMMENDATIONS WILL BE RELEASED TO THE PUBLIC ON THE DATE SHOWN ABOVE. NO PUBLIC DISSEMINATION OF THIS DOCUMENT SHOULD BE MADE PRIOR TO THAT DATE.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

April 15, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-75-27 issued March 20, 1975, and supplements our letter of May 27, 1975.

This is one of three recommendations (A-75-25 through A-75-27) issued as the result of the Board's investigation of the crash of a Northwest Airlines, Inc., Boeing 727, N274US, near Thielle, New York, on December 1, 1974. Recommendations A-75-25 and A-75-26 have been carried in a "Closed" status for some time.

A-75-27. Amend the applicable Federal Aviation Regulations (FAR) to require the pitot heating system to be on any time electrical power is applied to an aircraft. This should also be incorporated in the operator's operations manual.

FAA Comment. In our letter of May 27, 1975, we stated that this recommendation was impractical for general adoption because retrofit on existing aircraft presented many problems. Our response further stated that we propose to delete from consideration those aircraft which are limited to VFR flight only since they are not required to have any deicing capabilities. We identified some of the problems associated with retrofit of existing aircraft by contending that some cyclic installations will not tolerate continuous heat and would have to be completely replaced. Continuous heat would be unsafe in many circumstances such as extended parking with electrical power on. Reliability would be reduced leading to more frequent unsafe conditions in flight.

We did recognize an application for new design, stating that in these cases the recommendations may be feasible because the installations can be safe and reliable by design of interfacing electrical power systems, positioning of pitot tubes, and construction of pitot tubes.

A regulatory project was established and as a result Amendment No. 91-148 (43 FR 10339; March 13, 1978, Docket No. 15594) was issued on March 6, 1978. This amendment provided that after April 12, 1981, with certain exceptions, no person may operate a transport category airplane equipped with a flight instrument pitot heating system unless the airplane is also equipped with an operable pitot heat indication system that complies with Section 25.1326 of FAR Part 25. This rule applies to all transport category airplanes regardless of the type of operation being conducted.

On January 26, 1979, the National Business Aircraft Association, Inc. (NBAA), submitted a petition requesting that the April 12, 1981, compliance date be held in abeyance and also petitioned to amend the regulations to require that only transport category airplanes operated under Part 121, 123, 125, or 135 meet the requirement to have an operable pitot heat indication system. A summary of the NBAA's petition was published in the Federal Register on October 18, 1979 (44 FR 60107), and there were no comments. As the result of this petition, Amendment No. 91-172 (46 FR 19; January 2, 1981; Docket No. 18904) was issued on December 22, 1980, suspending the April 12, 1981, compliance date for operation of transport category airplanes when they are used in general aviation operations and not operations conducted under FAR Part 121, 123, 125, or 135. Simultaneously, Notice of Proposed Rulemaking (NPRM) Notice No. 80-27 (46 FR 76; January 2, 1981, Docket No. 18904) was published. This notice proposes to exclude general aviation operators from the requirement to install pitot heat indication systems to indicate to the flightcrew when the pitot heating system is not operating. The requirement would be retained for transport category airplanes operated under FAR Part 121, 123, 125, or 135. The closing date for comments on this notice was March 5, 1981.

The Federal Aviation Administration will inform the Board when further significant action is completed on Safety Recommendation A-75-27.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

MAY 27 1975

Honorable John H. Reed
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to your letter of March 12 which transmitted NTSB Safety Recommendations A-75-25 thru 27.

Recommendation No. 1.

Issue an Operations Bulletin to all air carrier and general aviation inspectors to stress the need for pilots to use attitude information when questionable information is presented on instruments that are dependent on the air data system. The information in this Bulletin should be disseminated to all operators for incorporation into their operations procedures and training programs. (Class 1)

Comment.

Air Carrier Operations Alert Bulletin 75-3 dated February 13 covers this subject. A Part 135, Air Taxi Bulletin, is being prepared. We are also considering the issuance of an advisory circular on the subject.

Recommendation No. 2.

Issue an Airworthiness Directive to require that a warning system be installed on transport category aircraft which will indicate, by way of a warning light, when the flight instrument pitot heating system is not operating. The warning light should operate directly from the heater electrical current. (Class 2)

Comment.

We do not concur in this recommendation. Some current aircraft have cycling types of pitot heaters. These cycle on and off as controlled by thermostats or timers. Warning lights would flash on and off with

the cycling. We consider this as distracting and possibly detrimental to safety. Other aircraft in which the pitot heat is controlled directly by a simple on-off switch could be modified by adding a power relay and warning light. We do not consider this necessary or desirable. Operation of pitot heat is on cockpit checklists and is well covered in operations manuals and crew training. In addition, the effectiveness of additional warning lights among the many warning lights presently installed in the cockpit is of doubtful value.

Recommendation No. 3.

Amend the applicable Federal Air Regulations to require the pitot heating system to be on any time electrical power is applied to an aircraft. This should also be incorporated in the operator's operations manual. (Class 2)

Comment.

This recommendation is considered to apply to all types of aircraft in service and to future designs. We propose to delete from consideration those aircraft which are limited to VFR flight only since they are not required to have any deicing capabilities.

Retrofit on existing aircraft presents many problems and we do not consider the recommendation practical for general adoption. Some cyclic installations will not tolerate continuous heat and would have to be completely replaced. Continuous heat would be unsafe in many circumstances such as extended parking with electrical power on. As you mentioned, reliability would be reduced leading to more frequent unsafe conditions in flight. We do not consider retrofit of existing aircraft practical or feasible.

For new designs the recommendation may be feasible because the installations can be safe and reliable by design of interfacing electrical power systems, positioning of pitot tubes, and construction of pitot tubes. A regulatory project leading to a Notice of Proposed Rule Making and subsequently a rule requiring an appropriately designed pitot heating system is being established.

Sincerely,

James E. Dow
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C. 20591

OFFICE OF
THE CHAIRMAN

March 12, 1975

Honorable Alexander P. Butterfield
Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear Mr. Butterfield:

Enclosed for your action is a safety recommendation approved by the National Transportation Safety Board.

The recommendation will be released to the public on the date indicated thereon. Please do not release any information contained in the recommendation before that date. We are sending this advance copy to you so that you can become familiar with its contents in order to answer any inquiries you may receive following public release of the document.

Advance copies are being sent to those addressees shown on the enclosed list.

Sincerely yours,

John H. Reed
Chairman

Enclosures

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

FOR RELEASE: 6:30 P.M., E.D.S.T., MAR. 20, 1975

ISSUED: March 20, 1975

Forwarded to:
Honorable Alexander P. Butterfield
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-75-25 thru -27

The National Transportation Safety Board is investigating the Northwest Airlines, Inc., Boeing 727, N274US, aircraft crash which occurred near Thielle, New York, on December 1, 1974. The Board's continuing investigation has revealed that ice blocked the pitot heads.

A preliminary review of the evidence in this accident suggests the possibility that the crew concentrated on air data instrumentation to the exclusion of aircraft attitude indications. The timely use of the attitude information may have prevented the stall and subsequent crash.

About 5 minutes before the rapid descent, the flight data recorder (FDR) recorded aberrations in the airspeed trace. These aberrations were caused by the closure of the ram air inlet and the drain hole of the pitot mast. These aberrations were verified by wind-tunnel icing tests of a pitot mast and pneumatic tests of an altimeter and airspeed system. These tests produced airspeed/altitude traces similar to those recorded on the FDR.

The Safety Board is aware of other incidents in which an aircraft encountered difficulties while flying in freezing precipitation because of a lack of pitot heat. In these incidents, the flightcrews recognized the problem and took corrective action.

Evidence in this case indicates that the pitot heater control switches were not on, although the heaters were capable of operation. The aircraft had been flying in clouds and freezing temperatures.

Recently, one air carrier reported that it is operating its pitot heater system continuously and the failure rate is minimal, i.e., one element failure per aircraft per year. Several other air carriers are actively considering the institution of a similar procedure, and they believe there would be no adverse affect on the life of the pitot heater elements.

The National Transportation Safety Board believes that corrective action is necessary and recommends that the Federal Aviation Administration:

1. Issue an Operations Bulletin to all air carrier and general aviation inspectors to stress the need for pilots to use attitude information when questionable information is presented on instruments that are dependent on the air data system. The information in this Bulletin should be disseminated to all operators for incorporation into their operations procedures and training programs. (Class 1)

2. Issue an Airworthiness Directive to require that a warning system be installed on transport category aircraft which will indicate, by way of a warning light, when the flight instrument pitot heating system is not operating. The warning light should operate directly from the heater electrical current. (Class 2)

3. Amend the applicable Federal Air Regulations to require the pitot heating system to be on any time electrical power is applied to an aircraft. This should also be incorporated in the operator's operations manual. (Class 2)

Our staff is available to assist your personnel in this matter, if desired.

REED, Chairman, McADAMS, THAYER, BURGESS, AND HALEY, Members, concurred in the above recommendations.

By: John H. Reed
Chairman

THESE RECOMMENDATIONS WILL BE RELEASED TO THE PUBLIC ON THE DATE SHOWN ABOVE. NO PUBLIC DISSEMINATION OF THIS DOCUMENT SHOULD BE MADE PRIOR TO THAT DATE.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

May 11, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-75-51 issued June 2, 1975, and supplements our letter of February 15, 1979. This also responds to your letter of May 22, 1980, in which you requested to be informed of the progress regarding this recommendation.

This recommendation was discussed at the NTSB/FAA Quarterly Meeting held on March 12, 1980, and the Board was updated on the status of our programs at that time. This recommendation continues to be carried in an "Open--Acceptable Action" status and, as you know, this entire subject of cabin delethalization has been addressed on numerous occasions. Various Safety Recommendations have been directed to this subject, the most recent being A-80-125 through A-80-131. The Federal Aviation Administration (FAA) response to these recommendations was furnished to the Board on April 3, 1981. Over the years, our efforts have been directed toward resolving cabin safety problems in both transport category and general aviation aircraft, and our respective staffs continue to hold ongoing discussions on this subject.

A-75-51. Amend 14 CFR 23.785(f) to require dynamic testing of seats to insure more realistic protection of occupants from serious injury in a minor crash.

FAA Comment. Our efforts in this area are still actively underway. There is an ongoing crashworthiness program in which we are evaluating the need for dynamic testing of seats. Meaningful dynamic tests cannot be required without understanding the acceleration pulse as experienced during real airplane crashes. We will consider a requirement for such testing upon completion of current programs which will establish crash scenarios for general aviation and transport airplanes.

SIMULA, Inc., is currently under contract to the FAA to complete and validate the single occupant, seat-restraint mathematical model. A draft report from SIMULA is due in September 1981. Following our review and incorporation of any changes, the final report will be available for printing during December 1981. The model's ability to predict seat-occupant-restraint system reaction to a crash pulse will be validated by comparison with test results obtained by the Civil Aeromedical Institute.

Although this program is exacting and time consuming, this approach is far more rational than that of requiring an arbitrary increase in seat strength which in turn could possibly lead to an increase in injury potential. Increased seat strength can be expected to increase seat rigidity which could increase crash loads transmitted to the seat occupant.

Accordingly, the FAA intends to continue our aggressive approach to this problem, and we will keep the Board informed of significant progress as our efforts continue.

Sincerely,

J. Lynn Helms
Administrator

Office of the
Chairman

National Transportation
Safety Board

Washington, D.C. 20594

May 22, 1980

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

This is to request an updated status report on National Transportation Safety Board Safety Recommendation A-75-51 issued June 2, 1975. In this recommendation we asked the Federal Aviation Administration (FAA) to amend 14 CFR 23.785(f) to require dynamic testing of seats to insure more realistic protection of occupants from serious injury in a minor crash.

The FAA's response of February 15, 1979, indicated that, among other programs, a notice of proposed rule making was being developed to amend TSO-C39a, which was expected to be completed by the end of 1979. In order to bring the public docket up to date, we request to be informed of the progress of this recommendation.

Sincerely yours,

James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

March 29, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to the Federal Aviation Administration's (FAA) letter of February 15, 1979, received in response to the National Transportation Safety Board's letter of November 9, 1978. The subject matter pertains to safety recommendation A-75-51 which proposes that the FAA:

> "Amend 14 CFR 23.785(f) to require dynamic testing of seats to insure more realistic protection of occupants from serious injury in a minor crash."

The Safety Board has taken note, and is appreciative, of the many actions taken and underway toward resolution of this recommendation. However, as expressed in our recommendations, we believe that the ultimate inertia forces as specified in 14 CFR 23.561 are not adequate to protect occupants in many severe but survivable accidents.

We will follow with interest the research and development projects being undertaken in support of crashworthiness programs, and we thank you for your offer to keep us advised of the progress of such programs. This recommendation is being maintained in an "Open - Acceptable Action" status.

Sincerely,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

February 15, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in reply to your letter of November 9, 1978, in which you discussed Safety Recommendations CY 70-42 and A-75-51 and urged the FAA to give its highest priority to a rulemaking project on minimum load factor requirements and a realistic certification test criteria for occupant seat restraint systems.

Our records indicate that National Transportation Safety Board Safety Recommendation CY 70-42 was "Closed" by Board action of December 7, 1977.

A-75-51. Amend 14 CFR 23.785(f) to require dynamic testing of seats to insure more realistic protection of occupants from serious injury in a minor crash.

Comment. The FAA has considered for some time the feasibility of changing the current structural design regulations in order to improve conditions pertinent to the protection of occupants of small airplanes in survivable crash conditions. The current design regulations, based on static inertia loads, may be amended to include dynamic loads.

A joint FAA-NASA General Aviation Crashworthiness Program was initiated in 1971. This program, which is still underway, includes phases for definition of crash environment, crash design concepts, development of mathematical models, and parameter verification through component and full-scale testing. Various research and development contracts were awarded in conjunction with the program. Test facilities used are at the Civil Aeromedical Institute (CAMI), the National Aviation Facilities Experimental Center (NAFEC) and the NASA Langley Impact Facility.

FAA research on seats concerns a man-seat model and efforts to validate it for future design. A three-dimensional computer program which simulates the response of seat, occupant and restraint system to a crash environment was developed and is currently in progress. Completion is scheduled for mid-1980.

Since the implementation of the General Aviation Crashworthiness Program, NASA has crash tested several general aviation type aircraft at Langley and obtained relevant crash data on fuselage structure, seats and occupant dummies. Four high-wing airplane crash tests were staged in conjunction with program "Crash," in which the objective was to analyze structural crashworthiness in probable crash conditions. Correlation studies have been made and a basic model completed. The intent is to provide manufacturers of small airplanes with this analytical tool. There is, however, insufficient data to develop a standard. Guidance material will be considered on completion of a trial period with the industry.

There is also a project underway to develop a mathematical model for crash simulation of aircraft structures using a finite element code called "Dycast." This is a long term project scheduled for completion in mid-1982.

In addition to the various research and development contracts in support of the General Aviation Crashworthiness Program, we are in the process of developing a notice of proposed rule making to amend TSO-C39a for seats. We expect to complete this project by the end of 1979.

Completion of the test programs described above will enable us to establish necessary relationships between static design loads and actual dynamic conditions. This will enable us to prescribe dynamic conditions in lieu of, or in addition to, the correct static criteria.

We will keep you advised of the progress of these programs.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

9 NOV 1978

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear Mr. Bond:

On November 12, 1976, an Avions Marcel Dassault Falcon 20F business aircraft crashed on takeoff from the Naples Municipal Airport, Naples, Florida. Investigation by the National Transportation Safety Board disclosed that the pilot was ejected from his restraint system when the right-hand seatbelt fitting was deformed, which allowed the seatbelt retaining pin to separate. This separation caused the end fitting of the seatbelt to slip free. A similar failure occurred in the copilot's right-hand seatbelt fitting; however, the seatbelt end fitting did not separate from the retaining pin in that case. The pilot was seriously injured when he struck numerous cockpit surfaces and protrusions as a result of the failure of his restraint system.

Subsequent tests revealed that the strength of the seatbelt fittings conformed to the ultimate load factors specified for TSO-C39a seats. However, analysis of these failures indicated that the loads imposed on the fittings were in excess of the load factor requirements of 14 CFR 23.561, especially those in the lateral direction. The Safety Board is concerned that critical failures of this kind continue to occur in otherwise survivable accidents and that airplane occupants are needlessly injured because of such failures.

As you know, the Safety Board over the last 8 years has been of the opinion that the ultimate inertia forces specified in 14 CFR 23.561 may not be adequate to protect the airplane occupant in severe but survivable accidents. This viewpoint was addressed in Safety Recommendation CY 70-42 and A75-51. While the Federal Aviation Regulations only provide protection for "a minor crash landing," considerable research by medically oriented investigators and by crash safety specialists has shown that significant savings in lives and injuries can accrue by increasing the minimum load factors for occupant/seat/restraint systems and by requiring realistic testing criteria for these systems.

The Safety Board has been following with much interest the progress on the full-scale controlled airplane crash tests being conducted by the National Aeronautics and Space Administration. We are aware also of the seat/occupant tests that were conducted at the National Aviation Facilities Experimental Center and the ongoing sled test program being conducted at your Civil Aeromedical Institute. The Boeing Company recently demonstrated successfully the capabilities of computers in predicting through mathematical modelling the behavior of seat/occupant/restraint systems during their investigation of the adequacy of flight attendant seats and associated restraint systems. The results of these research activities have strengthened our opinion regarding the viability of rule changes in these areas.

In view of the above, the Safety Board urges the FAA to give its highest priority to a rulemaking project on minimum load factor requirements and on realistic certification test criteria for occupant/seat/restraint systems. The Board would appreciate receiving a status report on your actions and proposed actions with respect to these matters.

Sincerely yours,

James B. King

James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

FOR RELEASE: 6:30 A.M., E.D.S.T., JUNE 2, 1975

ISSUED: June 2, 1975

Forwarded to:

Honorable James E. Dow
Acting Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-75-50 & 51

The National Transportation Safety Board's investigation of a Piper Seneca (PA-34-200) accident near Taos, New Mexico, on February 17, 1974, disclosed an unsafe seat design condition which should be corrected. Four standard passenger seats and one smaller passenger seat (7th seat), which were installed behind the pilot and copilot seats, separated from their attachments during the crash sequence and were found in a pile in the forward part of the cabin. These seats were attached to the floor by means of "quick disconnect" fittings so that the seats could be removed. Although the seatbelts were attached to the aircraft floor, none had been fastened around the empty seats.

During the crash sequence, deceleration forces were relatively moderate, based on the crash path and the aircraft damage. Additionally, autopsy findings and damage to the aircraft's instrument panel indicate that the pilot would have survived if he had been wearing the shoulder harness that was available. Nevertheless, the five unoccupied passenger seats came loose, were propelled forward in the cabin, and probably contributed to his injuries.

The Safety Board has learned from Piper Aircraft Corporation that these "quick disconnect" seats and their attachments have been tested statically and that the seats comply with 14 CFR 23 strength requirements. However, during the accident, the seats pulled out of their attachments under moderate dynamic loads.

Furthermore, Safety Board personnel inspected in-service aircraft with the "quick disconnect" seat installation and

determined that a slight jerk upward with one hand on the back of the seat will dislodge the aft fasteners; the seat was then free to rotate out of its forward fasteners. Although static tests for this seat installation showed that it would sustain 60 pounds ultimate upward load, an unoccupied, unbelted seat could easily be pulled loose.

During its investigation, the Safety Board learned that the FAA is also concerned about these seat failures and that an FAA Southern Region representative had contacted Piper Aircraft Corporation about the problem. On September 19, 1974, Piper reported to FAA's Southern Region that it had instituted several changes to correct the problem. These changes included an improved seat latching device on newly manufactured aircraft and revisions to the Owner's Handbooks, Pilot's Checklists, and Pilot's Operating Manuals of in-service aircraft to specify that seatbelts be fastened around unoccupied seats. Despite these actions, the Safety Board is concerned that the problem has not been solved.

Although the Safety Board believes that Piper's "improved new design unlocking device" will help to prevent seats on newer Piper aircraft from unlatching, the Board believes that the other actions will not prevent seats on in-service aircraft from coming loose. The same conditions which could cause the seat to come loose when empty could also cause it to come loose when the seatbelt is loosely fastened around an empty seat or an occupant. In view of the above, the Safety Board believes that this design deficiency should be corrected by a design change on in-service airplanes, as well as the design change on newly manufactured airplanes. The change to the Pilot's and Owner's Manuals by Piper is commendable; however, we consider it adequate only as an interim measure until a retrofit is accomplished.

The Safety Board also questions the adequacy of 14 CFR 23 certification criteria for static testing of seats and restraint devices. The seat attachments in this case, which had been certificated under 14 CFR 23, were not adequate and had to be redesigned. The Safety Board, therefore, reiterates its belief that crashworthiness standards for small aircraft should include dynamic testing of aircraft seats as a part of the certification requirements. The Safety Board further believes that the mechanism which caused the "quick disconnect" seats to fail would have been identified in the certification process if realistic dynamic tests had been made.

In a letter dated August 28, 1970, to the FAA Administrator, the Safety Board recommended dynamic testing of aircraft seats as part of a comprehensive crashworthiness program. The FAA responded on September 3, 1970, that they were contemplating rulemaking action, and on November 7, 1972, that sufficient data were not available to support a requirement that aircraft seats be dynamically tested. The latter response indicated that rulemaking would be undertaken as soon as data were available to support such action. The Safety Board believes that considerable data are available to show that dynamic testing of aircraft seats is necessary and can be accomplished with relatively simple equipment. For example, FAA report NA-69-5, "Dynamic Test Criteria for Aircraft Seats," shows explicitly that such tests are necessary and can be accomplished easily. The Safety Board believes that amendments to aircraft certification regulations requiring dynamic testing of seats to improve crashworthiness are necessary.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

1. Issue an Airworthiness Directive to require that an improved latching device be installed on all Piper aircraft designed with "quick disconnect" seat installations. (Class II)

2. Amend 14 CFR 23.785(f) to require dynamic testing of seats to insure more realistic protection of occupants from serious injury in a minor crash. (Class III)

REED, Chairman, McADAMS, THAYER, BURGESS and HALEY, Members, concurred in the above recommendations.

By John H. Reed
Chairman

THIS RECOMMENDATION WILL BE RELEASED TO THE PUBLIC ON THE ISSUE DATE SHOWN ABOVE. NO PUBLIC DISSEMINATION OF THE CONTENTS OF THIS DOCUMENT SHOULD BE MADE PRIOR TO THAT DATE.

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

May 20, 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

We thank you for your letter of May 1, 1981, further responding to National Transportation Safety Board Safety Recommendation A-76-13 issued March 8, 1976. This is one of seven recommendations that stemmed from our investigation of Overseas National Airways McDonnell Douglas DC-10-30 accident at John F. Kennedy International Airport, Jamaica, New York, on November 12, 1975. The aircraft caught fire during takeoff roll after encountering a flock of sea gulls which had been on the runway. Six of the seven recommendations were earlier resolved and placed in a closed status.

In Safety Recommendation A-76-13 we recommended that the Federal Aviation Administration (FAA):

> Revise FAA Form 5280-3, Airport Certification Safety Inspection, to include more detailed criteria for use by airport certification specialists to evaluate the bird hazard potential at an airport. These criteria should include, but not be limited to, migratory patterns, local attractants, and airport features likely to attract birds.

We have examined the revised and expanded version of FAA Form 5280-3, Airport Certification Safety Inspection. We are pleased to note that the revision includes more detailed criteria for use of airport certification specialists in evaluating the bird hazard potential. Safety Recommendation A-76-13 is now classified in a "Closed--Acceptable Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

May 1, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-76-13 issued March 8, 1976, and supplements our letter of April 14, 1978. This also responds to your letter of March 20, 1981, in which you requested confirmation of completed Federal Aviation Administration (FAA) action.

Recommendation A-76-13 is one of the seven safety recommendations issued as the result of the crash of Overseas National Airways Flight 632, at John F. Kennedy International Airport, Jamaica, New York, on November 12, 1975. All six other recommendations have been classified in a "Closed" status.

A-76-13. Revise FAA Form 5280-3, Airport Certification Safety Inspection, to include more detailed criteria for use by airport certification specialists to evaluate the bird hazard potential at an airport. These criteria should include, but not be limited to, migratory patterns, local attractants, and airport features likely to attract birds.

FAA Comment. The FAA has now completed its work on the expanded FAA Form 5280-3, Airport Certification Safety Inspection. This revised version includes more detailed criteria for use by airport certification specialists in evaluating the bird hazard potential at an airport. A copy of this document is enclosed, and the FAA considers action completed on Safety Recommendation A-76-13.

Sincerely,

J. Lynn Helms
Administrator

Enclosure

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

April 14, 1978

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S.W.
Washington, D. C. 20594

Dear Mr. Chairman:

This will supplement our June 16, 1976, response to NTSB Safety Recommendations A-76-8 through 14, and confirm action status information which has been furnished informally to NTSB staff personnel since our original response.

A-76-8. Parts (b) and (c) were covered in our June 16, 1976, response. As to part (a), forecasting is an ongoing problem and only time and experience will provide the expertise to forecast to any predictable degree the behavior patterns of the birds on and around John F. Kennedy International Airport (JFK). As the learning curve progresses, this program will become more effective. With respect to actions to disperse birds at Port Authority airports, patrols are in constant operation and dispatched to disperse birds from the airport by means of noise devices, distress calls, crackershells, and, under extreme conditions, live ammunition when the birds fail to react to the nonlethal stimuli. In response to part (d), the Chapel Pond at JFK was drained and monitored for bird activity for a three-month period. After that time, it was filled and also monitored for bird activity. After a three-month period, it was determined that the pond did attract a substantial number of birds. As a result, it was drained again and has remained so.

A-76-9. At JFK, the provisions of (a) and (b) of the recommendation are being accomplished by their Bird Hazard Patrol. The study referred to in our original response to this recommendation was conducted by representatives from all parts of the headquarters' staff plus regional representatives. No complete study report was ever published. However, the findings and recommendations of the group were incorporated in Federal Aviation Administration (FAA) Order 5200.6, Guidelines for the National Plan on Bird Hazard Detection and Control, dated November 15, 1976 (copy enclosed), which is being implemented by all regions.

A-76-10. A special program was established to review the airport operations manuals on a semiannual basis to ensure that they were being maintained in an up-to-date status and to assure that the provisions of their bird hazard reduction programs are adequate. Our certification staff continued this program through several cycles. We now find that the operations manuals, and the bird hazard reduction programs contained therein, are adequate and current.

A-76-11. Order 5200.6, particularly paragraph 6.c.(2), provides for appropriate action in response to this recommendation.

A-76-12. This recommendation was closed by Board action June 16, 1977, based on "Acceptable Alternate Action."

A-76-13. The expansion of FAA Form 5280.3, Airport Certification Safety Inspection, to include more detailed criteria for use by airport certification specialists in evaluating the bird hazard potential at an airport should be completed within the next 60 days. A copy of the revised form will be furnished to the Board as soon as available.

A-76-14. In our June 16, 1976, response we indicated that our comments in response to A-76-8 included the areas of concern in this recommendation. The FAA is working closely with The Port Authority of New York and New Jersey to improve measures for the control of these problems. However, some items detailed in the recommendation cannot be positively implemented since they are outside the jurisdiction of the Port Authority and the FAA. Implementation of Order 5200.6 provides a basis for consideration of all items listed in the recommendation.

The ecological studies previously made by the Department of Interior have been modified to take into consideration the economic facts of life. All recommendations have been fulfilled or have been partially fulfilled in accordance with the economic facts previously mentioned.

With the exception of A-76-13, FAA feels it has completed appropriate actions, within its jurisdictional authority, on all of these recommendations. Other than continuing those procedures already established, we plan no further actions at this time.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosure

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

March 20, 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Please refer to the Federal Aviation Administration letter of April 14, 1978, containing a response to National Transportation Safety Board Safety Recommendation A-76-13. The letter indicated that actions were being taken to resolve this recommendation. In order to evaluate its present status and update the public docket, we request your confirmation of completed action.

Sincerely yours,

James B. King
James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

June 16, 1976

OFFICE OF
THE ADMINISTRATOR

Honorable Webster B. Todd, Jr.
Chairman, National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-76-8 through 14.

1. The Federal Aviation Administration (FAA) requested that the Port Authority of New York and New Jersey advise concerning the plan to implement the four recommendations. The Port Authority has responded. The reply was not considered completely satisfactory. As a result, a meeting was held May 20 between the Eastern Region of the FAA and the U.S. Fish and Wildlife Service.

With the concurrence of the U.S. Fish and Wildlife Service we have made the following conclusions with respect to Items (a) through (d).

(a) Additional work needs to be accomplished.

(b) We concur with the Port Authority that removal of the pier is not necessary provided a modification which will prevent roosting or resting by birds is made.

(c) We also concur with the Port Authority that the beaches adjacent to the south and east boundaries of the airport do not cause a bird problem.

(d) The balloons flying above the Chapel Pond are not effective. The pool should be drained.

We are transmitting the above conclusions to the Port Authority. We will request that the Port Authority report on Items (a) and (d) within 30 days.

2. The determination of what constitutes a "recognized bird hazard problem: is a complex, variable science to which no definitive set of standards or criteria can be developed for all airports. We have, however, initiated a study to identify those certificated airports having large concentrations of birds which could be a hazard. Analysis of the results of the study should provide direction for action. We expect the study to be completed in nine months.

3. A detailed review of the Airport Operations Manual is made during each annual inspection of an airport. Consideration is being given to several possible revisions to Operations Manuals in the area. The results expected from the studies underway and contemplated should define and ensure compliance with manual contents and indicate the frequency of reviews necessary on a case by case basis. We anticipate that the above actions will be completed within one year.

4. When the study identified in Item 2 is completed, we will determine the type of specialized expertise needed within each jurisdictional area.

5. The study and subsequent analyses described in Item 2 may indicate a necessity for formal ecological studies to determine the fact of any existing hazardous conditions and methods for hazard reduction. Any expansion of our current undertaking or efforts to regulate are limited by economic impact, Federal financial assistance capability, and available FAA resources.

6. Concurrently with studies initiated on bird hazards we will revise FAA Form 5280-3, Airport Certification Safety Inspection, to provide guidance to certification inspectors on bird hazards. We expect to complete the revision concurrent with the study identified in Item 2.

7. Our comments on Item 1 include the areas of concern in this recommendation. The FAA is working hand in hand with the New York and New Jersey Port Authority to develop measures for the control of these problems.

Sincerely,

Original signed by:

John McLucas
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 8, 1976

Forwarded to:

Honorable John L. McLucas
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-76-8 thru 14

On November 12, 1975, Overseas National Airways Flight 032, a McDonnell Douglas DC-10-30, caught fire during the takeoff roll on runway 13R at John F. Kennedy International Airport (JFK), Jamaica, New York. The fire erupted in the area of the right engine after the aircraft encountered a flock of sea gulls which had been on the runway.

The National Transportation Safety Board's investigation of the accident revealed that the Federal Aviation Administration (FAA) and the Port Authority of New York and New Jersey had been concerned with the increasing number of bird strikes at JFK during 1975. Measures to reduce the bird hazard had been implemented on a piecemeal basis and did not equal the measures considered adequate by the FAA and the Port Authority after the accident.

In addition, the Safety Board's investigation revealed that the Chapel Pond, located on the center of the airport, and the pier associated with the abandoned runway 7-25 serve as attractants for birds and should be removed. Three ecological studies have been conducted at the airports operated by the Port Authority. As a result of these studies, actions were recommended to reduce the bird hazards to aircraft operations. The Safety Board notes that the recommendations for a bird patrol unit and for an ecologist/ornithologist to administer the Port Authority environmental program had not been implemented before the accident. The Safety Board believes that these recommendations are still valid and that they should be applied at the Port Authority airports.

The Safety Board also believes that JFK's procedure of physically inspecting a runway and dispersing the birds before designating it the active runway is a sound measure. Although the practice was not mandatory in October 1975, none of the five reported bird strikes at JFK during the month occurred during the periods the bird patrol was operated. This practice has been effective at JFK and should be required at all controlled airports which have a recognized bird problem.

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During the initial certification inspection of JFK, FAA certification specialists determined that the bird problem was a hazard. However, the evaluation criteria contained in Airport Certification Safety Inspection (FAA Form 5280-3) is a statement of fact and provides no detailed checklist to be used by the inspector and airport manager. Expanded evaluation criteria would enable the certification specialist to perform a more complete inspection, while at the same time provide definitive safety guidelines for the airport management.

14 CFR 139.67 requires an airport operator to demonstrate that it has procedures to prevent or reduce a bird hazard. The Board considers the ramifications of an effective bird-hazard control program to be complex enough to warrant an ecological study as the basis for the program. Such a study would enable the operator to consider all the elements necessary for a viable program, and would provide the FAA an accurate measure of program effectiveness. This study should be required only at airports the Administrator has determined to have a bird hazard.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

1. In coordination and cooperation with the Port Authority of New York and New Jersey, expedite the following actions:

   (a) Determine the weather conditions, ocean tide conditions, seasonal factors, migratory patterns, and daily movement patterns which could be used to forecast periods of greatest bird hazards at the Port Authority of New York and New Jersey airports and take effective actions to disperse the birds before use of the affected runways is permitted.

   (b) Remove the abandoned runway 7-25 pier at JFK.

   (c) Remove the bird attraction to the beach adjacent to the south and east boundaries of the airport by eliminating the beach through gravel fill, dredging, a seawall or other appropriate means.

   (d) Drain the Chapel Pond at JFK. (Class II-Priority followup.)

2. Require a physical inspection of a runway and adjacent areas at each controlled airport certificated under 14 CFR 139, which has a recognized bird-hazard problem on each occasion before:

(a) Designating that runway as the active runway, or

(b) allowing takeoffs from other than the active runway (Class II-Priority followup.)

3. Frequently review the operations manual for each airport certificated under 14 CFR 139 which has a recognized bird hazard problem to assure that the provisions of their bird-hazard reduction program are adequate. (Class II-Priority followup.)

4. Require that a specially trained, staffed, and equipped bird-dispersal organization be established at each controlled certificated airport with a recognized bird-hazard problem. (Class III-Longer-Term followup.)

5. Amend 14 CFR 139.67 to require that, where the Administrator finds that a bird hazard exists, an ecological study be conducted to determine the measures necessary for an effective bird-hazard reduction program. (Class III-Longer-Term followup.)

6. Revise FAA Form 5280-3, Airport Certification Safety Inspection, to include more detailed criteria for use by airport certification specialists to evaluate the bird hazard potential at an airport. These criteria should include, but not be limited to, migratory patterns, local attractants, and airport features likely to attract birds. (Class III-Longer-Term followup.)

7. Assist and encourage the Port Authority to implement the recommendations contained in the previous ecological studies of Port Authority airports. Specifically, these studies offered the following remedial measures:

(a) For John F. Kennedy International Airport:

(1) Eliminate the two dumps and several sewer outlets which attract gulls.

(2) Drain or fill the several small marshes and ponds on the airport.

(3) Dredge mudflats or cover them with gravel to eliminate shore bird concentrations.

(4) Remove the wire fence at the southeast end of the airport.

(5) Dispose of food-bearing plants such as bayberry, tall stands of phragmites, and other dense growths of vegetation used for roosting purposes. This may be done by burning, cutting, bulldozing, or with herbicides.

(6) Shoot or trap rodents and rabbits which attract birds of prey.

(7) Employ a well supervised shotgun patrol to repel birds from critical airport areas. The patrols should use shell crackers, and to a limited extent, live ammunition.

(b) For LaGuardia Airport:

(1) Consider the appointment to the New York Airports of an environmental specialist to coordinate the programs of bird control.

(2) Fill temporary water areas, and alter habitat in the headland area by bulldozing or the use of herbicides.

(3) Continue a shotgun patrol and the use of scare devices.

(4) Communicate with the New York City Department of Public Works to explore possibilities for minimizing gull access to domestic waste. Elimination of food sources will substantially reduce the local gull population.

(c) For Newark International Airport:

(1) Bird and other wildlife habitat at the airport be altered by drainage, cutting, bulldozing, or use of herbicides.

(2) Grasshoppers be controlled by applying either insecticides, or through cultural practices.

(3) Newly constructed areas not be landscaped with ornamental trees, shrubs, or brush.

(4) A shotgun and scare device patrol be continued.

(5) A collection of bird/plane and near-miss data be continued.

(6) A man be appointed full-time to eliminate bird hazards.

(7) The Port of New York Authority influence the termination of the Oak Island and Elizabeth Dumps, and

prohibit the development of proposed dump sites near the airport. (Class II-Priority followup)

TODD, Chairman, McADAMS, THAYER, BURGESS, and HALEY, Members, concurred in the above recommendations.

By: Webster B. Todd, Jr.
Chairman

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 1, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-76-31 through 36 and A-76-42 through 44 issued April 1, 1976. This also responds to your requests for updated status reports dated July 21, 1980, and April 17, 1981. We note that Recommendations A-76-37 through 41 were previously closed by official Board action.

These 14 safety recommendations were issued to the Federal Aviation Administration (FAA) as a result of the Eastern Airlines Boeing 727 accident near the John F. Kennedy International Airport at New York on June 24, 1975. At the NTSB/FAA Quarterly Meeting held on March 12, 1980, the FAA was advised that a number of these recommendations were in an "Open" status awaiting further response from the FAA. Action has been completed on Recommendations A-76-37, 38, 39, 40, and 41, and these recommendations have been classified in a "Closed" status. Accordingly, this response addresses Recommendations A-76-31, 32, 33, 34, 35, 36, 42, 43, and 44.

A-76-31. Conduct a research program to define and classify the level of flight hazard of thunderstorms using specific criteria for the severity of a thunderstorm and the magnitude of change of the wind speed components measured as a function of distance along an airplane's departure or approach flight track and establish operational limitations based upon these criteria.

FAA Comment. In manned-flight simulation studies conducted by the FAA, NASA, and industry in 1977-1979, it was found that the longitudinal acceleration capability of an airplane may provide one means to characterize the wind shear penetration capability of an airplane.

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Implementation of operational limitations based on such concepts will require, however, more accurate characterization of the variations in windspeed components in and near thunderstorms and development of a means for the pilot to assess this information.

Research programs initiated by the FAA in conjunction with the National Severe Storm Laboratory of the Department of Commerce and NASA to determine the magnitude of windspeed component changes associated with thunderstorms are continuing. Highly instrumented aircraft are being used to penetrate areas of severe weather conditions, the severity of which is measured simultaneously by ground-based radar equipment capable of accurately tracking the aircraft and of measuring the magnitude of the windspeed components. NASA and the FAA are at the same time collaborating in an evaluation of the usefulness of airborne weather radar to identify areas of hazardous wind shear conditions using modifications of existing systems. The FAA, NASA, and the Department of Commerce are also continuing collection and analyses of severe weather windspeed component data collected from instrumented towers to better characterize wind conditions associated with thunderstorms.

With the information derived from these programs and with the use of the Next Generation Radar (NEXRAD) in terminal areas supported by data link capabilities which are also under development, the FAA expects to be able to improve the information on wind shear conditions available to the pilot.

In May 1979, the FAA published an Advanced Notice of Proposed Rulemaking (ANPRM) concerning requirements for airborne wind shear systems. It is possible that an NPRM may eventually be issued, but we cannot forecast an issuance date since this action is incorporated in our current review of regulatory initiatives. This airborne equipment will enable an aircrew to avoid penetration of wind shear areas or, if caught in such conditions, more safely navigate them. It is anticipated that in the longer term, as the ongoing FAA/NASA programs provide the capability to measure wind components, this information may be processed and displayed using avionics to be developed for that purpose.

We believe these ongoing efforts satisfy the intent of Safety Recommendation A-76-31. Accordingly, the FAA considers action completed on this recommendation.

A-76-32. Expedite the program to develop and install equipment which would facilitate the detection and classification, by severity, of thunderstorms within 5 nmi of the departure or threshold ends of active runways at airports having precision instrument approaches.

FAA Comment. The FAA has developed and is implementing a Low-Level Wind Shear Alert System (LLWSAS) designed to detect the horizontal wind shear caused by thunderstorm gust fronts and strong cold fronts in the

vicinity of an airport. The LLWSAS has been implemented and is working well at 24 U.S. airports; installation has been contracted for 34 more airports in 1980 and 1981.

Another ground-based concept to detect thunderstorm outflows which generate gust fronts has also been tested at Atlanta-Hartsfield International Airport. Considered an enhancement to the LLWSAS, it employs pressure sensitive equipment to detect rapid changes in pressure that accompany thunderstorm gust fronts to permit location and tracking of such fronts as they move through approach and departure zones. Preliminary assessments indicate, however, that in its present configuration, the incidence of false alarms may be unacceptably high.

The FAA has also tested a pulse Doppler radar system for use in detection of wind shear in airport approach and departure zones. Initial results indicate that wind direction and speed can be obtained; however, the size of the installation and costs of implementing such a concept using existing technology may be prohibitive.

Because these latter efforts have not led to useful products, emphasis has been placed on further implementation of LLWSAS, development of airborne detection and avoidance equipment, and further radar development. The FAA is a participant with other administrations within the Department of Transportation and with the Departments of Defense and Commerce in a major R&D program to develop the NEXRAD capable of detecting the movement and severity of routine and hazardous weather phenomena, including thunderstorms. The NEXRAD is expected to significantly enhance the detection, classification, and tracking of thunderstorms. The goal for installation of the first operational system is FY-86, and the goal for reaching the full system capability is FY-89. The FAA is pursuing the exploration, development, and implementation of these concepts as rapidly as congressional funding and manning level policies permit. Programs are also underway to develop data link and flight service station (FSS) automation capabilities that will facilitate the transmission of hazardous weather information to the cockpit.

In view of our progress with this program and the continuing R&D efforts, we believe the intent of this recommendation has been satisfied. Accordingly, the FAA considers action completed on Safety Recommendation A-76-32.

A-76-33. Install equipment capable of detecting variations in the speed of the longitudinal, lateral, and vertical components of the winds as they exist along the projected takeoff and approach flightpaths within 1 nmi of the ends of active runways which serve air carrier aircraft.

FAA Comment. The FAA, in conjunction with other government agencies, has invested substantial R&D resources in the development of sensors to detect variations in wind components. These sensors include acoustic

radar, Doppler radar, pulsed laser Doppler, FM/CW (frequency modulation/continuous wave) radar, and acoustic pulsed radar. To date, each of these systems has been found to have technical or economic limitations making implementation impractical.

The NEXRAD program in which the FAA is participating is expected to invest even more substantial resources in the development of radar wind shear detection equipment. The product is not anticipated, however, until late in the 1980's. Even then, because of economic considerations, it may develop that this capability may not be implemented at many of the smaller air carrier serviced airports.

The most promising method of detecting and coping with wind shear conditions developed to date incorporates airborne sensing equipment, a knowledge in the cockpit of winds in the touchdown zone based on data obtained from ground sensing equipment, and an electronic glide slope reference. As a result, the FAA is increasing the number of Instrument Landing Systems (ILS's) at air carrier serviced airports, and implementing the Microwave Landing System that will provide electronic glide slope information in locations where installation of an ILS is impractical. In addition we are proceeding with rulemaking action to require the necessary airborne equipment, developing a data link system to provide timely wind information as well as other hazardous weather information in the cockpit, and, as noted earlier, we are expanding the ground-based LLWSAS. The FAA FSS Automation Program will also enhance the transmittal of hazardous weather information to the cockpit.

In consideration of these efforts, and in recognition of the technological constraints associated with this recommendation, we believe our actions constitute an acceptable alternate solution to satisfy the intent of A-76-33. Accordingly, the FAA considers action completed on this recommendation.

A-76-34. Require inclusion of the wind shear penetration capability of an airplane as an operational limitation in the airplane's operations manual, and require that pilots apply this limitation as a criterion for the initiation of a takeoff from, or an approach to, an airport where equipment is available to measure the severity of a thunderstorm or the magnitude of change in wind velocity.

FAA Comment. As we indicated in our response to Recommendation A-76-31, it is possible to define the acceleration capability or wind shear penetration capability of an airplane. It has been found, however, that translation of these parameters into operational limitations involves too many variables for useful incorporation into an airplane's operational manual. The FAA is, however, proceeding with the preparation of advisory circular material dealing with installation and use of airborne equipment to be used by the aircrew for the purpose addressed in the subject

recommendation. We will forward a copy of this material to the Board when published. With the publication of these documents, the FAA considers action on Safety Recommendation A-76-34 completed.

A-76-35. As an interim action, install equipment capable of measuring and transmitting to tower operators the speed and direction of the surface wind in the immediate vicinity of all runway ends and install lighted windsocks near to the side of the runway, approximately 1,000 feet from the ends, at airports serving air carrier operations.

FAA Comment. The FAA is installing a system that provides for comparison of windspeed and direction, sensed at remote locations on the airport, relative to those values sensed at center field locations. This system called the LLWSAS has been favorably evaluated and is now operational at 24 airports. There are 34 more systems under contract, and delivery will begin on or about October 1, 1981, at the rate of one per week (also see our response to A-76-32).

We have further considered the feasibility of a program effort relative to lighted windsocks. After in-depth study and discussions, it is still our contention that this concept has limited value, and we do not intend to pursue a development effort.

Accordingly, we believe our LLWSAS evaluation and installation effort satisfies the intent of Safety Recommendation A-76-35 and, therefore, the FAA considers action completed on this recommendation.

A-76-36. Develop and institute procedures whereby approach controllers, tower controllers, and pilots are provided timely information regarding the existence of thunderstorm activity near to departure or approach flightpaths.

FAA Comment. There are currently 18 FAA Air Route Traffic Control Centers (ARTCC's) with commissioned Center Weather Service Units (CWSU). Present plans call for installation and testing of auto dial conference call capabilities in the CWSU at the Indianapolis ARTCC. This will allow the CWSU to provide weather information to positions within terminal radar facilities and FSS's that have an En Route Flight Advisory Service (EFAS) function. We plan to use the FSS automation system components to disseminate weather information to FSS's and CWSU's; and our National Airspace Data Interchange Network (NADIN) for communication between CWSU's and FSS's with cathode-ray tube (CRT) displays (1982 budget). An operational test/evaluation of the Color Weather Radar System at Cleveland ARTCC is scheduled for completion by the end of the year. We will keep the Board informed of significant progress in this program effort.

A-76-42. Expedite the research to develop equipment and procedures which would permit a pilot to transition from instrument to visual references without degradation of vertical guidance during the final segment of an instrument approach.

FAA Comment. The FAA is proceeding in several areas with the development of equipment and procedures to permit transition from instrument to visual references during the final segments of the instrument approach. Implementation of autoland is proceeding with the publication of procedures and certification of aircraft facilities and aircrews for Category III operations. The FAA is expanding the implementation of ILS's to provide that service to a wider user group at more locations. The FAA also has underway a program to install additional Visual Approach Slope Indicator (VASI) systems at some precision and many nonprecision approach runways. As of June 30, 1980, the FAA had installed 823 VASI's under the F&E program on runways used by air carriers. Since our last report in 1978, 402 of these have been installed. Evaluations of variations to the VASI system are also underway, including the Precision Approach Path Indicator, that would provide additional information on aircraft position with respect to a selected glide slope relative to the reference glide slope (an advantage to widebody aircraft).

The FAA has amended Parts 91 and 121 of the Federal Aviation Regulations to revise and clarify criteria for the commencement and continuance of instrument approaches and certain requirements applicable to the instrument landing procedures and minimums. These amendments clarify provisions of the current rules, add new provisions necessary to ensure safety in landing in poor visibility, and update regulations to be consistent with current FAA and industry practices and procedures.

In addition, research for longer term solutions has been expedited. The results of a joint FAA/NASA program to determine the benefits to safety during the transition attributable to a head-up display of information are expected early in 1981. Additional study by NASA of the contribution of the head-up display to autoland operations is planned in 1981. Further understanding of the benefits and limitations of a head-up display is expected from flight evaluations to be conducted by the FAA in 1981-1982 using head-up-display-equipped aircraft. Approval of a head-up display for use on a supplemental basis has been completed on the recently certificated DC-9-80 as a result of experience gained by FAA certification specialists in the FAA/NASA program.

We believe these actions fully satisfy the intent of Safety Recommendation A-76-42 and, accordingly, the FAA considers action completed on this recommendation.

A-76-43. Expedite the research to develop an airborne detection device which will alert a pilot to the need for rapid corrective measures as an airplane encounters a wind shear condition.

FAA Comment. As a result of an extensive 4-year study conducted by the FAA, with the support of NASA and industry, the FAA has concluded that practical solutions are available that will make it possible to avoid many of the problems experienced by air carriers involved in wind shear encounters. These various solutions are addressed herein in our comments responding to Safety Recommendations A-76-31 through A-76-36. Accordingly, the FAA considers action on Safety Recommendation A-76-43 completed.

A-76-44. Expedite the development of a program leading to the production of accurate and timely forecasts of wind shear in the terminal area.

FAA Comment. Please refer to our response to Safety Recommendation A-76-35. We believe our progress with the LLWSAS satisfies the intent of this recommendation. Moreover, in our response to A-76-31, we refer to research programs initiated by the FAA in conjunction with the National Severe Storm Laboratory, the Department of Commerce, and NASA to determine the magnitude of windspeed component changes associated with thunderstorms. As stated earlier, these efforts are continuing. Also in this response to A-76-31, we describe additional programs by the FAA and NASA which are designed to evaluate the usefulness of airborne weather radar to identify areas of hazardous wind shear, and collection and analyses of severe weather windspeed component data from instrumented towers. Finally, we are working closely with the National Weather Service in evaluating the feasibility of recording equipment to continuously record wind direction and speed at airports where hourly surface weather observations are made. We will address this effort in more detail in our response to Safety Recommendation A-80-141, which is currently in preparation. In consideration of these continuing efforts, the FAA considers action on Safety Recommendation A-76-44 completed.

Sincerely,

J. Lynn Helms
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

April 17, 1981

Honorable J. Lynn Helms
Administrator Designate
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

As a result of the Eastern Airlines Boeing 727 accident near the John F. Kennedy International Airport at New York on June 24, 1975, the Safety Board made 14 recommendations to the Federal Aviation Administration (FAA). At the last two NTSB/FAA Quarterly Meetings, the FAA staff was advised that a number of these recommendations were in an open status awaiting a further response from the FAA.

Also, in reply to a written request for an updated status report, we were advised on July 28, 1980, to expect an answer in the near future. We are nxious to evaluate the progress of these recommendations and would very much ppreciate an updated status report.

Sincerely yours,

James B. King

James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

July 21, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

As a result of the Eastern Airlines Boeing 727 accident near the John F. Kennedy International Airport at New York on June 24, 1975, the Safety Board made 14 recommendations to the Federal Aviation Administration (FAA). At the last NTSB/FAA Quarterly Meeting held on March 12, 1980, the FAA staff were advised that a number of these recommendations were in an open status awaiting a further response from the FAA. In order to evaluate the progress of the recommendations and update the public docket, we would appreciate an updated status report.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

JUL 7 1976

Honorable Webster B. Todd, Jr.
Chairman, National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Rec ommendations A-76-31 through 44.

Recommendation No. 1. Conduct a research program to define and classify the level of flight hazard of thunderstorms using specific criteria for the severity of a thunderstorm and the magnitude of change of the windspeed components measured as a function of distance along an airplane's departure or approach flight track and establish operational limitations based upon these criteria.

Comment. The Federal Aviation Administration (FAA) has already initiated a research program in conjunction with the National Severe Storms Laboratory to determine the magnitude of windspeed component changes in thunderstorms by using a highly instrumented aircraft to penetrate actual thunderstorms. The associated characteristics of the thunderstorms and level of flight hazard are currently being investigated in a second research program which will determine the detrimental effects on aircraft performance and controllability as a function of windspeed component changes. If the results of this research show that meaningful and clearly defined operational limitations can be established based upon these criteria, then we may proceed with appropriate rulemaking. We expect to complete the research by December 1978.

Recommendation No. 2. Expedite the program to develop and install equipment which would facilitate the detection and classification, by severity, of thunderstorms within 5 nmi of the departure or threshold ends of active runways at airports having precision instrument approaches.

Comment. Experimental thunderstorm gust front detection systems will be tested on a high priority basis beginning this summer at Chicago O'Hare and Dulles Airports. These test systems should provide us with the data required to design a production system which could provide

sufficient warning of the approach of any hazardous thunderstorm gust fronts. In addition, we have completed testing and are presently preparing procurement specifications for a radar display device which will portray thunderstorm location and severity derived from an existing remote weather or long range radar. The information is transmitted digitally over telephone lines to the display located in appropriate air traffic control sites.

Recommendation No. 3. Install equipment capable of detecting variations in the speed of the longitudinal, lateral, and vertical components of the winds as they exist along the projected takeoff and approach flightpaths within 1 nmi of the ends of active runways which serve air carrier aircraft.

Comment. The equipment described by the NTSB in this recommendation does not currently exist and, therefore, no installations are possible at this time. However, the FAA, in conjunction with other government agencies, has programs underway to develop and/or refine sensors which are capable of detecting variations in wind components. These sensors include acoustic doppler, doppler radar, pulsed laser doppler, FM/CW radar, and acoustic pulsed radar. Each of these systems has its own technical and economic advantages and limitations; FAA is striving to determine as rapidly as possible which of the many candidates offer the greatest enhancement to safety along the lines of this recommendation with an acceptable cost. We expect to complete this by June 1978.

Recommendation No. 4. Require inclusion of the wind shear penetration capability of an airplane as an operational limitation in the airplane's operations manual, and require that pilots apply this limitation as a criterion for the initiation of a takeoff from, or an approach to, an airport where equipment is available to measure the severity of a thunderstorm or the magnitude of change in wind velocity.

Comment. As stated in our response to the first recommendation, we are currently pursuing the research necessary to establish wind shear related operational limitations for general aircraft types. Regulatory steps must await the successful completion of the research and the installation of appropriate measurement equipment.

Recommendation No. 5. As an interim action, install equipment capable of measuring and transmitting to tower operators the speed and direction of the surface wind in the immediate vicinity of all runway ends and install lighted windsocks near to the side of the runway, approximately 1,000 feet from the ends, at airports serving air carrier operations.

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SUMMARY OF FEDERAL AVIATION ADMINISTRATION RESPONSES TO NATIONA--ETC(U)
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Comment. At present, we are installing anemometers near six runway ends at Chicago O'Hare Airport, and we are planning to make similar installations at Atlanta, Houston, and Denver. However, at present, there is disagreement between aviation meteorological experts as to whether the most appropriate location for anemometers is at the runway threshold, the middle marker, or the outer marker. Other experts feel that microbarographs are superior to anemometers in detecting the most hazardous conditions. FAA is currently conducting research to answer these questions before spending large sums of money on installations which may later prove to be ineffective. (For example, the NTSB's proposed wind measurement location would probably be ineffective in the case of a departing aircraft encountering a thunderstorm gust front shear just past the departure end of the runway.) We expect to complete this research by December 1978.

We believe that lighted windsocks are of limited value and may be a distraction to pilots during low ceiling/visibility operations.

Recommendation No. 6. Develop and institute procedures whereby approach controllers, tower controllers, and pilots are provided timely information regarding the existence of thunderstorm activity near to departure or approach flightpaths.

Comment. Action on this recommendation would be redundant as the FAA has existing programs informing control personnel and users regarding thunderstorm activity. Part of the existing system includes National Weather Service (NWS) data, visual observation, radar data and pilot reports. It should be noted that our on-going "thunderstorm activity" information is just one of the many diversified and necessary types of weather data integral to the system (National Airspace System), and provided through existing procedures and programs. A sampling of other significant weather information includes reports concerning areas of strong frontal activity, squall lines, widespread fog, moderate to heavy icing, turbulence, or similar conditions pertinent to the safety of flight. In our efforts to improve existing procedures, arrangements have been agreed to between the FAA and NWS to test a procedure to alert elements of the air traffic control system and airborne pilots of thunderstorms observed by NWS weather radars 30 miles or closer to any of five major terminals in the Washington, D.C., and New York City areas.

The test has been arranged to determine whether this type of information may be effective operationally to enhance safety.

The test will involve NWS weather radars at Patuxent River, Maryland, Atlantic City, New Jersey, and New York City, New York. FAA facilities participating in the test will include Central Flow Control Facility, Leesburg, Virginia, and Islip, New York, Air Route Traffic Control Centers (ARTCCs), and Air Traffic Control Towers at LaGuardia, New York, J. F. Kennedy, New York, Philadelphia, Pennsylvania, Newark, New Jersey, and Washington National Airport.

NWS weather radar observers, upon detecting a strong weather return, will notify the duty meteorologist at the FAA's Central Flow Control Facility advising him of the location, intensity, and movement of the storm. The Central Flow Control Facility meteorologist will then alert the appropriate air traffic control tower and air route traffic control center. These facilities, in turn, will advise pilots operating in the affected area.

Test procedures will be in effect from June 1 through October 31. An evaluation of the effectiveness of the test will determine whether to extend, expand, or curtail the effort.

Comments from the aviation industry are solicited for use in evaluation.

Recommendation No. 7. Revise appropriate air traffic control procedures to specify that the location and severity of thunderstorms be considered in the criteria for selecting active runways.

Comment. The apparent concern of the NTSB, i.e., adverse winds associated with thunderstorm activities, may be widely separated from the actual observable thunderstorm activity. Accordingly, runway selection on the basis of other than known winds actually affecting the runway in use could very easily result in operational conditions not acceptable by users and, in fact, have an adverse effect/impact on safety in the system. We believe the present air traffic control procedures, which require aircraft to be informed of phenomena likely to produce an adverse safety effect and those requiring avoidance of known areas of possible hazard to safety, provide the best current means of providing pilots the information they need to assess and determine the most appropriate action for their operation. Decisions of this nature must remain with the pilot.

Insofar as severity is concerned, air traffic control has no present effective means of assessing the current severity of thunderstorm activity or the area of airspace that may be affected.

Recommendation No. 8. Modify or expand air traffic controller training programs to include information concerning the effect that winds produced by thunderstorms can have on an airplane's flightpath control.

Comment. The FAA Academy portion of the Air Traffic Training Program which began on January 13 contains a lesson on "Turbulence and Jetstreams." The lesson includes categories of turbulence intensity. Types of turbulence on an airplane's flightpath control is covered in great detail. As we learn more about the causes and effects of wind shear, our training syllabus will be modified accordingly.

Recommendation No. 9. Modify initial and recurrent pilot training programs and tests to require that pilots demonstrate their knowledge of the low-level wind conditions associated with mature thunderstorms and of the potential effects these winds might have on an airplane's performance.

Comment. Air Carrier Operations Bulletin No. 75-8, Subject: Low Level Wind Shear, was issued on December 30, 1975. This bulletin requires our principal operations inspectors to ensure compliance with the recommendations enumerated in this item.

An advisory circular on wind shear phenomena was published on April 8. This circular will be of value to both air carrier and general aviation pilots.

Recommendation No. 10. Expedite the program to develop, in cooperation with appropriate Government agencies and industry, typical models of environmental winds associated with mature thunderstorms which can be used for demonstration purposes in pilot training simulators.

Comment. The FAA, in conjunction with the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA), has already developed models of environmental winds associated with mature thunderstorms and is currently testing them in a piloted simulator. We will make these models available to operators of pilot training simulators. We expect the model to be available by October 1976.

Recommendation No. 11. Place greater emphasis on the hazards of low-level flight through thunderstorms and on the effects of wind shear encounter in the Accident Prevention Program for the benefit of general aviation pilots.

Comment. We concur with this rcommendation. We believe that forceful instruction and pilot tests on the knowledge of hazards of low-level wind shear will reinforce the pilot's respect for this particular weather phenomenon. Air taxi pilots are now required to demonstrate this knowledge during initial and recurrent pilot training (Handbook 8430.1A, Operations Bulletin 75-4). Additionally, an FAA Advisory Circular, Low Level Wind Shear, was published April 8.

Accident prevention specialists will continue to emphasize the hazards of marginal weather operations, particularly around thunderstorm activity.

Recommendation No. 12. Expedite the research to develop equipment and procedures which would permit a pilot to transition from instrument to visual references without degradation of vertical guidance during the final segment of an instrument approach.

Comment. The FAA is currently installing over 100 additional VASI systems over the next two years to facilitate the pilot's transition from instrument to visual vertical guidance on approach. In addition, we have just initiated a program to examine the heads-up display as an aid in providing vertical guidance in both wind shear and other meteorological environments. We expect to complete this examination by September 1978.

Recommendation No. 13. Expedite the research to develop an airborne detection device which will alert a pilot to the need for rapid corrective measures as an airplane encounters a wind shear condition.

Comment. The FAA is already well underway with two separate research programs to identify such a device. The programs involved the use of a piloted simulator and a nonpiloted digital aircraft simulator, respectively. Final reports will be available soon from the first phase of both programs, and second phases will be initiated soon to complete development of an airborne wind shear detection device. We expect completion of these programs by December 1976.

Recommendation No. 14. Expedite the development of a program leading to the production of accurate and timely forecasts of wind shear in the terminal area.

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Comment. The National Weather Service has responded positively to an FAA request to provide wind shear forecasts at eight major east coast terminals. A six-month test will begin in August 1976.

Sincerely,

John L. McLucas
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 1, 1976

Forwarded to:

Honorable John L. McLucas
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-76-31 through 44

On June 24, 1975, Eastern Air Lines Flight 66, a Boeing 727, crashed during a precision instrument approach to the John F. Kennedy International Airport, Jamaica, New York. One hundred and thirteen persons died from the injuries that they received.

The National Transportation Safety Board's investigation of the accident disclosed that the aircraft developed a high descent rate as it passed through or below the base of a mature thunderstorm. The storm was astride the approach course and approximately 1 mile from the end of the runway. The pilots of other flights which preceded Flight 66 on the approach reported that they too had encountered problems in controlling their aircraft to maintain a safe approach profile. These aircraft avoided an accident possibly because the prevailing conditions were less severe or because the pilots recognized and responded to the situation faster than the pilots of Flight 66.

A study of flight recorder data taken from these flights showed that the performance of each of the aircraft was affected by the strong vertical drafts and changes in the direction of the horizontal winds in the vicinity of the thunderstorm. When a simulator, modeled to reproduce the aerodynamic characteristics of the B-727, was exposed to these approach conditions, it became evident that the ability of an airplane to negotiate a safe landing or even a missed approach was marginal. In the case of Flight 66, impact might possibly have been avoided had the flightcrew recognized the onset of the descent rate more quickly.

However, even though they had been alerted to a wind shear condition, the crew probably did not anticipate the rapid change in the airplane's flight profile. Also, since they had both the approach lights and subsequently the runway in sight, they were probably relying on visual cues for guidance, particularly since the glideslope was designated unusable below 200 feet. There were no visual aids such as VASI to help them detect the deviation below a safe glidepath.

The circumstances of this accident are similar to those of other accidents which have been investigated by the Safety Board. On May 18, 1972, an Eastern Air Lines Douglas DC-9-31 touched down hard on the runway at Fort Lauderdale, Florida; the airplane was destroyed and three persons were injured. On July 23, 1973, an Ozark Air Lines, Inc., Fairchild Hiller FH-227B crashed while on a precision approach to the Lambert-St. Louis International Airport, St. Louis, Missouri. Thirty-seven passengers died in that crash. On January 30, 1974, a Pan American World Airways, Inc., Boeing 707 crashed while on approach to Pago Pago, American Samoa, killing 96 persons. In all of these crashes, the airplanes were penetrating heavy rain and probably the adverse wind conditions associated with a mature thunderstorm.

The potential hazards of flight through or below a fully developed thunderstorm are well recognized. In fact, most, if not all, air carrier operations have established a policy to avoid the intense radar echoes by 20 miles or more when flying at cruising altitudes. This policy is consistent with Advisory Circulars 00-24 and 90-12A. In the terminal environment, however, there appears to be a tendency on the part of pilots, as well as traffic controllers, to let the desire for an uninterrupted flow of traffic interfere with an objective evaluation of the hazard potential of approaches through or under thunderstorms. Consequently, approaches are being conducted through these hazardous conditions during what is perhaps the most critical phase of flight -- when the aircraft is at low altitude, with little airspeed margin, and with the airplane in a high drag configuration.

The Safety Board recognizes the problems in the terminal area which stem from traffic density, air traffic control coordination requirements, complex departure and arrival routes, and adjacent airports. These factors, combined with the characteristics of rapidly developing thunderstorms and the limited weather detection capability of the ATC radar equipment, hinder the coordinated effort which must be made by pilots and controllers to avoid thunderstorms. Nevertheless, the Safety Board believes that these problems can and must be resolved in order to prevent more accidents of this kind.

Since 1973, the Safety Board has submitted to the Administrator, Federal Aviation Administration, eight specific recommendations which can be directly related to accidents involving approaches through conditions similar to those encountered by Flight 66. Copies of these recommendations and the Administrator's responses are attached. The recommendations concerned such areas as the expansion of authority for air traffic controllers to deny approaches or takeoffs through thunderstorms, the development of ATC radar with better severe weather detection capability, the implementation of better systems to relay severe weather warnings to pilots, the installation of VASI on all instrument runways, the issuance of training material and improvements in training programs to stress the effect of wind shear on an airplane's flightpath control, and the development of wind shear detection devices.

The FAA has expressed agreement with many of these recommendations and in some cases action has been taken to comply. In other cases, action has not been taken.

The Safety Board believes that the continuing occurrence of approach accidents involving passage of an airplane through or below thunderstorms indicates that more positive and more immediate actions are necessary. Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration, in coordination with the National Oceanic and Atmospheric Administration, where appropriate:

1. Conduct a research program to define and classify the level of flight hazard of thunderstorms using specific criteria for the severity of a thunderstorm and the magnitude of change of the wind speed components measured as a function of distance along an airplane's departure or approach flight track and establish operational limitations based upon these criteria. (Class II - Priority Followup)

2. Expedite the program to develop and install equipment which would facilitate the detection and classification, by severity, of thunderstorms within 5 nmi of the departure or threshold ends of active runways at airports having precision instrument approaches. (Class II - Priority Followup)

3. Install equipment capable of detecting variations in the speed of the longitudinal, lateral, and vertical components of the winds as they exist along the projected takeoff and approach flightpaths within 1 nmi of the ends of active runways which serve air carrier aircraft. (Class II - Priority Followup)

34 4. Require inclusion of the wind shear penetration capability of an airplane as an operational limitation in the airplane's operations manual, and require that pilots apply this limitation as a criterion for the initiation of a takeoff from, or an approach to, an airport where equipment is available to measure the severity of a thunderstorm or the magnitude of change in wind velocity. (Class II - Priority Followup)

35 5. As an interim action, install equipment capable of measuring and transmitting to tower operators the speed and direction of the surface wind in the immediate vicinity of all runway ends and install lighted windsocks near to the side of the runway, approximately 1,000 feet from the ends, at airports serving air carrier operations. (Class I - Urgent Followup)

36 6. Develop and institute procedures whereby approach controllers, tower controllers, and pilots are provided timely information regarding the existence of thunderstorm activity near to departure or approach flightpaths. (Class I - Urgent Followup)

37 7. Revise appropriate air traffic control procedures to specify that the location and severity of thunderstorms be considered in the criteria for selecting active runways. (Class I - Urgent Followup)

38 8. Modify or expand air traffic controller training programs to include information concerning the effect that winds produced by thunderstorms can have on an airplane's flightpath control. (Class III - Longer-Term Followup)

39 9. Modify initial and recurrent pilot training programs and tests to require that pilots demonstrate their knowledge of the low-level wind conditions associated with mature thunderstorms and of the potential effects these winds might have on an airplane's performance. (Class II - Priority Followup)

40 10. Expedite the program to develop, in cooperation with appropriate Government agencies and industry, typical models of environmental winds associated with mature thunderstorms which can be used for demonstration purposes in pilot training simulators. (Class III - Longer-Term Followup)

41 11. Place greater emphasis on the hazards of low-level flight through thunderstorms and on the effects of wind shear encounter in the Accident Prevention Program for the benefit of general aviation pilots. (Class II - Priority Followup)

42 12. Expedite the research to develop equipment and procedures which would permit a pilot to transition from instrument to visual references without degradation of vertical guidance during the final segment of an instrument approach. (Class III - Longer-Term Followup)

43 13. Expedite the research to develop an airborne detection device which will alert a pilot to the need for rapid corrective measures as an airplane encounters a wind shear condition. (Class III - Longer-Term Followup)

44 14. Expedite the development of a program leading to the production of accurate and timely forecasts of wind shear in the terminal area. (Class III - Longer-Term Followup)

TODD, Chairman, McADAMS, THAYER, BURGESS, and HALEY, Members, concurred in the above recommendations.

By: Webster B. Todd, Jr.
Chairman

Attachments

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 11, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is further response to NTSB Safety Recommendations A-76-80 and A-76-81 issued June 10, 1976. This also replies to your letter of September 22, 1980, in which you requested a further response from the Federal Aviation Administration (FAA) on this subject.

These recommendations were made, initially, because of concerns arising from the Eastern Air Lines Boeing 727 accident at Raleigh-Durham Airport on November 12, 1975. The specific observation by the Board was that "the restraint system of the forward flight attendant's jumpseat, as installed, can contribute to unnecessary injuries to flight attendants during in-flight turbulence or during crash landings." The discussion accompanying the recommendation did not, though, point to any injury sustained by a flight attendant in the forward jumpseat, which is aft facing. The Board also observed that generally, from information included in the U.S. Army Crash Survival Design Guide (USAAMRDL Technical Report 71-22), "a seatbelt should be installed to provide an angle of 45° to 55° with the seatpan."

The FAA, in its reply of September 8, 1976, to the Board, agreed that the usual practice was to position the seatbelts at a 45-degree angle relative to the seatpan. The FAA pointed out, though, that other design factors may combine to cause this angle to deviate and that during type certification, the Boeing 727 flight attendant seatbelt angle was evaluated and not found to be detrimental to the safety of the occupant. A more recent observation is that specification of the angle has little meaning alone, without considering the point of attachment. A belt attached at 45 degrees to a point well behind the seat (as is done in some installations) still may not be positioned properly on the seated occupant. Thus, as is FAA practice, each individual installation must be evaluated for safety. In its letter, the FAA also pointed out that there have been no medical test data which substantiate the detrimental effects of the Boeing 727 flight attendant belts. The FAA advised the

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Board that it was not aware of any accident injuries attributed to the use of seatbelts attached at angles outside the range recommended by the Board, and has no record of adverse service experience. Over the last 4 years the Board has not made such data available to the FAA.

These recommendations have remained in an "Open--Unacceptable Action" status with interim responses provided by the FAA through both informal staff coordination and discussion at NTSB/FAA quarterly meetings. When discussed at the quarterly meeting on March 12, 1980, the NTSB minutes reflect "These recommendations were discussed at the last two NTSB/FAA Quarterly Meetings. It was agreed then that we would respond and let the FAA know why we had kept these recommendations in 'Open--Unacceptable Action' status." At that meeting, the Board's technical representatives were referred to the Boeing Report entitled "PROMETHEUS" (Boeing Document D6-44779TN-0), which substantiated the FAA's earlier position that seatbelts attached at angles other than the range recommended by the Board were not inherently unsafe. At the March 12 meeting, the Board's technical representatives indicated that they were unaware of the "PROMETHEUS" report.

The Board has apparently evaluated the foregoing report as the premise for its letter of September 22, 1980, in which it refers to the "PROMETHEUS" mathematical model. The Boeing report resulted from an Aerospace Industries Association TARC Project 216-10, initiated at the request of the FAA. An old version of the "PROMETHEUS" mathematical two-dimensional model was already in existence and had an established reputation for applications in helicopters, rail cars, automobiles, and passenger seat restraint, energy attenuation installations. This is why the TARC Committee selected the Boeing "PROMETHEUS" model for refinements to incorporate parameters necessary to assess the validity of the Board's recommendations.

The Board's letter also established recommendations which it would view as "alternate acceptable actions." These three alternate acceptable actions are not, however, supported by reference to any specific accidents or incidents wherein mispositioned seatbelts have led to flight attendant injuries. Such injury statistics or a clear definition of an unsafe condition would be necessary to justify the costly research recommended by the Board. The Board should also be aware that any retrofit of existing flight attendant seats would be extremely costly and this cost must be offset by identifiable safety benefits. In the absence of injury statistics or an unquestionably serious safety hazard, it would be almost impossible to quantify the safety benefits.

The FAA wishes to note that the Board's recommendations were not "summarily rejected by the FAA", as stated by the Board in its September 22 letter. The FAA rejection of the Board's recommendations was based upon facts articulated in our September 8, 1976, letter which

have never been refuted by the Board. The "PROMETHEUS" report validates the FAA position, and the Board itself indicates that its original recommendations may have been "unduly restrictive." In an attempt to concisely restate the technical issues embodied in the two recommendations, and FAA's position, we are again responding to the recommendations.

A-76-80. Issue an Airworthiness Directive to require that the seatbelt tiedown rings on all Boeing 727 forward jumpseats be relocated so that the seatbelt will be positioned across the occupant's pelvic girdle at the recommended angle with the seatpan of 45° to 55°.

FAA Response. The Board, in its September 22, 1980, letter, points out that its recommendations may have been unduly restrictive in citing the seatbelt guidelines of 45 to 55 degrees, and states that it is impressed with the work Boeing has done in its "PROMETHEUS" study. The FAA concurs on both points. One of the "PROMETHEUS" findings, cited by the Board in its letter and concurred in by the FAA, is that achieving optimum restraint and safety is dependent on evaluating all the influences and all the interacting elements of a total seat and restraint system configuration. With that conclusion in mind, FAA has reviewed the Board's first alternate acceptable action to:

> "Conduct fundamental dynamic tests of seatbelts with and without shoulder harnesses on rigid seats to determine the probability of injury and the type of injuries which might be produced by seatbelts which are permitted to ride above the illiac crest of the pelvis."

We cannot understand the rationale for this recommendation, since tests conducted on "rigid seats" clearly will yield different results than tests conducted on flexible seats. In most cases, rigid seat results would be useless in predicting injury criteria for real-life flexible seats. Also, the Board has not provided dynamic test criteria. The Board is fully aware of the FAA's efforts toward establishing dynamic criteria for testing seats, and has issued other recommendations on the subject. The FAA considers flight attendant seats no different than any other aircraft seat and any test criteria developed by the ongoing FAA programs would also apply to them. We consider these FAA programs to fulfill the intent of this alternate acceptable action.

The second alternate acceptable action has merit. On February 4, 1980, the FAA issued Amendment 25-51 which revised FAR 25.785 to upgrade safety requirements for flight attendant seats, and Amendment 121-155 which revised FAR 121.311 to retroactively apply the FAR 25.785 flight attendant seat requirements to airplanes in air carrier operations. These amendments require significantly upgraded flight attendant seats

and have resulted in many seats no longer being approved for use. The Board, in its letter, acknowledges that design improvements are being phased into production aircraft, and the FAA believes that this, combined with the recent rule changes, has accomplished the intent of this alternate acceptable action, so that further action is unnecessary.

The third alternate acceptable action to "Establish seat restraint system certification criteria based on tests and simulation results" also has merit, but the language is unclear, and it is hard for the FAA to determine what would be an acceptable action. We believe, however, that the FAA programs noted in the previous paragraph, which are geared to development of such criteria, fulfill the intent of this alternate acceptable action.

Beyond what is being done on transport category seat standards as a result of the public hearing on July 30, 1980, the FAA is presently initiating a revision to TSO-C39a, Aircraft Seats and Berths, to include specific dimensional and energy absorption requirements for flight attendant seats, and is revising TSO-C22 to include requirements for shoulder harness installations. The direct result of these and other programs within the FAA will be a general upgrading of flight attendant and passenger seat standards. These actions also meet the intent of the Board's last two acceptable actions. The FAA, therefore, considers action complete on this recommendation.

A-76-81. Inspect the flight attendant jumpseats on all other air carrier aircraft to insure that the seatbelt tiedown are positioned properly; where improper installations are found, take immediate action to require that the tiedowns be relocated.

FAA Response. In our September 8, 1976, reply to the Board, the FAA indicated that flight attendant seat restraint systems were examined. From this examination and acceptable service experience, the FAA found that all tiedowns were properly positioned. Thus, the FAA has fully complied with the Board's recommendation. If the Board is aware of any unsafe flight attendant seat installations and wishes to make the information available to the FAA, we will thoroughly investigate the installations. Short of such data being provided by the Board, the FAA intends to take no further action on this recommendation and considers action completed on this recommendation.

Sincerely,

J. Lynn Helms
Administrator

National Transportation
Safety Board

Office of the
Chairman

September 22, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear Mr. Bond:

Safety Recommendations A-76-80 and 81 dated June 10, 1976, regarding the recommended seatbelt angle for flight attendant jumpseats on Boeing 727 and other air carrier aircraft, have been discussed in depth at past NTSB/FAA quarterly meetings. These two recommendations currently are being held in an open unacceptable action status. Safety Recommendations A-76-80 and 81 were intended to highlight the importance of proper seatbelt positioning and the potential for injury due to mispositioned seatbelts.

The FAA initially responded to Safety Recommendations A-76-80 and 81 on September 8, 1976. The arguments presented in defense of nonconcurrence seemed inconsistent. It was stated that a survey made of all other air carrier aircraft revealed that flight attendant jumpseat tiedowns were properly positioned. However, part of FAA's logic for dismissing the Safety Board's recommended angle was that seatbelts used at retractable flight attendant jumpseats were attached to basic aircraft structure on most narrow-bodied jets, thus making it difficult to comply with the recommended angle. In addition, FAA stated that ". . . the effect of seat adjustment and possible seat deformation in a crash has been considered; and seatbelts which subtend a slightly reduced angle with the seatpan have been approved." FAA also stated that ". . . no record of medical test data substantiates that detrimental effects would be sustained by occupants using seatbelts at angles representative of the Boeing 727."

Much time has elapsed since the subject safety recommendations were released and additional information was gathered on the subject. The most important new information was the investigation of flight attendant restraint systems conducted by The Boeing Company in cooperation with other Aerospace Industries Association (AIA) members. In response to the Board's safety recommendations, Boeing developed a restraint system mathematical model called "PROMETHEUS." The final report is Boeing Document D6-44779TN-0, dated June 1978, "Attendant Restraint System Technical Evaluation and Guidelines," revised May 18, 1979. The report's

primary conclusion is that achieving optimum restraint and safety is dependent on evaluating all the influences and all the interacting elements of a total seat and restraint system configuration.

As a result of this study, Boeing presently is offering its customers extensive improvement options in flight attendant seats and their restraint systems, including headrest improvements, reconfigured backrests for improved lumbar support, revised structural provisions for restraint system attachments, and a five-point belt and harness assembly. These improvements also are being introduced into production aircraft.

The Safety Board is impressed with the initiative and the extensive voluntary efforts of industry in investigating a safety problem identified by the Board after this problem had been summarily rejected by the FAA. The Safety Board believes that the FAA should investigate further the nature of occupant/seat/restraint system interaction with a view towards establishing more definitive design, installation and test criteria guidelines.

In view of the results of the above-mentioned Boeing study, Safety Recommendations A-76-80 and 81 may well have been unduly restrictive in citing the then commonly accepted seatbelt angle guidelines of 45 to 55 degrees. However, the Board believes that the intent of these recommendations still is valid. Therefore, as alternate acceptable action, the FAA should complete the following items to fulfill the intent of Safety Recommendations A-76-80 and 81:

1. Conduct fundamental dynamic tests of seatbelts with and without shoulder harnesses on rigid seats to determine the probability of injury and the type of injuries which might be produced by seatbelts which are permitted to ride above the illiac crest of the pelvis.

2. Continue the research and development of "PROMETHEUS" or a similar mathematical model to better analyze the interaction of the occupant/seat/restraint system and to determine the best angle for seatbelts with and without shoulder harnesses.

3. Establish seat restraint system certification criteria based on tests and simulation results.

The Safety Board awaits your response at which time a decision can be made whether the Board should revise the status of Safety Recommendations A-76-80 and 81.

Sincerely yours,

James B. King
Chairman

8

Honorable Webster B. Todd, Jr.
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-76-80 and 81.

Prompted by the NTSB recommendations, we conducted an extensive investigation to determine if an underlying safety problem existed which would justify retroactive airworthiness directive (AD) action. Inquiry was made of the Civil Aeromedical Institute for pertinent medical tests data and records of any injuries sustained by flight attendants that could be attributed to the use of seatbelts. In addition, an evaluation of the service histories of the Boeing 727 and similar type aircraft was accomplished.

Recommendation No. 1. Issue an AD to require that the seatbelt tiedown rings on all Boeing 727 forward jump seats be relocated so that the seatbelt will be positioned across the occupant's pelvic girdle at the recommended angle with the seat pan of 45 degrees to 55 degrees.

Comment. The usual practice employed in design of passenger restraint systems is to position the seatbelt tiedowns such that the belt centerline is at a 45 degree angle relative to the seat pan. Normally, the seatbelt tiedowns are located on the seat structure; however, for other seats—such as flight attendant seats—this is not practical, and basic aircraft structure is utilized to anchor the tiedowns. This is the situation with many of the flight attendant automatic retractable jump seats installed on the narrow-body transport category—such as the Boeing Model 727 airplane in question. In these cases, the effect of seat adjustment and possible seat deformation in a crash has been considered; and seatbelts which subtend a slightly reduced angle with the seat pan have been approved. In evaluating these installations during original type design certification, this aspect was not found to be detrimental to the safety of the seat occupant.

Our investigation revealed there was no record of medical test data which substantiates that detrimental effects would be sustained by occupants using seatbelts at angles representative of the Boeing 727. We are not aware of any accident injuries that can be attributed to the use of seatbelts of which the angle with the seat pan is outside the range recommended by the NTSB, and we have no record of adverse service experience.

Based on the results of these investigations, we conclude that a critical unsafe condition does not exist, and issuance of an AD is not warranted.

Recommendation No. 2. Inspect the flight attendant jump seats on all other air carrier aircraft to insure that the seatbelt tiedowns are positioned properly; where improper installations are found, take immediate action to require that the tiedowns be relocated.

Comment. Flight attendant seat restraint systems on all other air carrier aircraft were examined including those of the wide-body jumbo jets. Results of this examination and supporting service history indicate that the tiedowns are properly positioned; therefore, no further action is contemplated.

Sincerely,

(Signed) J. W. Cochran
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

FOR RELEASE: 6:30 P.M., E.D.T., JUNE 10, 1976
(202) 426-8787

ISSUED: June 10, 1976

Forwarded to:

Honorable John L. McLucas
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-76-80 and 81

On November 12, 1975, an Eastern Air Lines Boeing 727 crashed short of the runway at Raleigh-Durham Airport, Raleigh, North Carolina. 1/ The National Transportation Safety Board's investigation of that accident has disclosed that the restraint system of the forward flight attendant's jumpseat, as installed, can contribute to unnecessary injuries to flight attendants during in-flight turbulence or during crash landings.

Investigation disclosed that the seatbelt tiedown rings on the forward bulkhead are installed far enough above the seatpan that, when the belt is worn, little or no angle exists between the seatbelt and the seatpan. Consequently, the seatbelt passes across the soft tissues of the abdomen, instead of passing across the medial and anterior aspects of the pelvic girdle.

According to information supplied by the Armed Forces Institute of Pathology (AFIP), a seatbelt that is worn higher than the hips may cause the pelvis to rotate when the body is subjected to longitudinal and vertical loads, especially when the seatpan cushion is not firm. When the lower torso rotates, or "submarines," beneath the seatbelt, the soft abdominal viscera are exposed to the seatbelt loads. To prevent this exposure, a seatbelt should be installed to provide an angle of 45° to 55° with the seatpan. This method of seatbelt positioning is recommended in the U. S. Army's Crash Survival Design Guide (USAAMRDL Technical Report 71-22).

1/For more detailed information on this accident, read "Aircraft Accident Report: Eastern Air Lines, Inc. Boeing 727-225, N8838E, Raleigh, North Carolina, November 12, 1975 (AAR-76-15)."

1807A

FAA's Civil Aeromedical Institute (CAMI) in Oklahoma City also has warned of the potential dangers of mispositioned seatbelts. A properly positioned seatbelt will stabilize the lower torso and will assure that the decelerative forces are applied to the bony structure of the pelvis instead of to the vulnerable viscera in the abdomen. The fact that the B-727 forward jumpseat is aft-facing does not negate the necessity for a properly positioned seatbelt because injury can occur equally from longitudinal decelerations and from lateral, roll-over, and rebound forces.

The AFIP reported that typical injuries which can result from mispositioned seatbelts include lacerations of intestines, mesentery, pancreas, stomach, liver, and major arteries and veins. These injuries can be further aggravated when the seatbelt buckle compresses the abdominal organs against the vertebral column. Also, "submarining" causes flexion of the spine and increases the probability of vertebral fractures. CAMI has cited diagnostic difficulties as the dangerous aspects of internal injuries, since their symptoms are sometimes overlooked or discounted as indicators of a severe intra-abdominal injury.

The Safety Board has learned that similarly mispositioned seatbelts are also installed on flight attendant seats in Douglas DC-8 and DC-9 aircraft, and on Boeing 707 aircraft; the Safety Board is equally concerned about the potential hazard to jumpseat occupants in these aircraft.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

1. Issue an Airworthiness Directive to require that the seatbelt tiedown rings on all Boeing 727 forward jumpseats be relocated so that the seatbelt will be positioned across the occupant's pelvic girdle at the recommended angle with the seatpan of 45° to 55°. (Class II - Priority followup)

2. Inspect the flight attendant jumpseats on all other air carrier aircraft to insure that the seatbelt tiedowns are positioned properly; where improper installations are found, take immediate action to require that the tiedowns be relocated. (Class II - Priority followup)

TODD, Chairman, McADAMS, HOGUE, BURGESS, and HALEY, Members, concurred in the above recommendations.

By: Webster B. Todd, Jr.
Chairman

THESE RECOMMENDATIONS WILL BE RELEASED TO THE PUBLIC ON THE ISSUE DATE SHOWN ABOVE. NO PUBLIC DISSEMINATION OF THIS DOCUMENT SHOULD BE MADE PRIOR TO THAT DATE.

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

MAY 12

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

This is to thank you for Report No. FAA-AAS-80-1, titled "National Runway Friction Measurement Program" delivered by a member of your staff. This report was mentioned in the Federal Aviation Administration's (FAA) letter of September 11, 1979, in connection with National Transportation Safety Board Safety Recommendations A-76-136 and -137 issued November 18, 1976. These recommendations stemmed from our investigations of accidents and incidents involving pilot inability to stop an aircraft on a wet and slippery runway.

We were informed in earlier responses to these recommendations that it is not the intention of the FAA to make Advisory Circular 150/5320-12 mandatory. However, now that the report has been published and additional information gained, we request to be informed of the following:

- Does the FAA plan to have runway friction standards for certificated and noncertificated airports?
- What will be an airport operator's responsibility in this area?
- Will pilots be warned of slippery runway conditions?
- How often will runway friction surveys be made?

Safety Recommendations A-76-136 and -137 remain in an "Open--Unacceptable Action" status pending the FAA's further response.

We thank you for your cooperation and efforts to promote air transportation safety.

Sincerely yours,

James B. King
Chairman

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

May 1, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to your letter of March 4, 1981, requesting a progress report on Federal Aviation Administration (FAA) actions regarding Safety Recommendations A-76-136 and 137. These recommendations were issued as a result of incidents involving wet runway overruns.

A-76-136. All portions of AC 150/5320-12 applicable to the testing and maintenance of paved runway surfaces be required as a condition for continuous certification of all airports utilized by turbine-powered air carrier aircraft, and be incorporated into 14 CFR 139.

A-76-137. Until such time as the above provisions of AC 150/5320-12 are made mandatory, require that periodic friction surveys, as outlined in Chapter 5 of AC 150/5320-12, be conducted on all runways certificated under 14 CFR 139. Also require that appropriate corrections be taken if unsafe surface conditions exist or that timely cautionary notices, such as NOTAMS, be issued if immediate corrections cannot be made and operational considerations dictate continued use of the runway.

FAA Comment. The national program surveys have been completed and the final report is enclosed for your information (Report No. FAA-AAS-80-1, National Runway Friction Measurement Program). The report analyzes results and makes recommendtions regarding revisions to AC 150/5320-12. The only work remaining on the friction measurement contract involves the preparation of computer use and documentation manuals. These will enable FAA to add information from future friction surveys to the data base and to assist airport operators in analyzing the results.

We expect revision of the advisory circular to be completed by the end of calendar year 1981 and a copy will be forwarded to the Board.

Sincerely,

J. Lynn Helms
Administrator

Enclosure

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

MAR - 4 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Please refer to the Federal Aviation Administation's (FAA) letter of September 11, 1979, responding to the National Transportation Safety Board's Safety Recommendations A-76-136 and -137 and our reply of January 28, 1980. These recommendations stemmed from incidents involving pilot inability to stop an aircraft on a wet runway.

The FAA's response indicated that approximately 270 air carrier airports were being given friction and pavement condition surveys and that on completion of this project the FAA would revise Advisory Circular 150/5320-12 and provide safety information to airport operators. In our reply of January 28, 1980, we stated that we were maintaining these recommendations in an "Open - Unacceptable Action" status pending the completion of the FAA's project. We now request an updated progress report.

Sincerely,

James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

January 28, 1980

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of September 11, 1979, informing the National Transportation Safety Board of the alternative actions taken by the Federal Aviation Administration (FAA) to satisfy Safety Recommendations A-76-136 and A-76-137. These recommendations stemmed from our investigations of incidents involving pilot inability to stop an aircraft on a runway. We have found that frictional characteristics of some runway surfaces have not been sufficiently maintained to provide effective braking action, particularly during wet runway conditions. In both recommendations and in followup actions, the Safety Board has taken the position that regulatory requirements should be established to assure safe runway surface friction levels.

Through verbal and written communications between our two agencies, we have been repeatedly informed that the FAA does not intend to make friction measurement a regulatory requirement because of insufficient standards and authentic guidance material. We are also informed that the FAA opposes instituting the recommended regulatory actions for economic and technologic reasons, and that regulatory action will prove unacceptable to a large majority of airport operators.

Except for the FAA's opposition to regulatory action, we appreciate being advised of the many actions taken and underway to upgrade standards and improve airport pavement surfaces including the FAA's national program to perform runway surface friction measurements to gather data for developing new standards. We trust that the information gained will help airport operators to better evaluate runway surface conditions, provide timely information to pilots, and provide the basis for the regulatory action recommended. In view of the FAA's present inability

to establish a regulatory requirement because of insufficient background information, these recommendations will be classified in an "Open--Unacceptable Action" status pending completion of the FAA's ongoing programs.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

September 11, 1979

Honorable James B. King
Chairman
National Transportation Safety Board
Washington, D. C. 20594

Dear Mr. Chairman:

At the NTSB/FAA Quarterly Meeting on July 13, it was agreed that we would provide a status report on the actions being taken concerning the runway friction measurement program referenced in Recommendations A-76-136 and A-76-137.

As indicated in our letters of February 15, 1977, and April 10, 1978, we do not intend to make friction measurement a regulatory requirement because of insufficient standards and authentic guidance material. It is necessary to refine and update the technical data and standards used in advisory circular 150/5320-12. In order to establish the necessary background information, we have embarked upon a national program with a contractor who has been engaged to perform runway surface friction measurements to gather data for developing new standards. After the completion of the contract, we should have obtained sufficient technical data to make a judgment and determination for providing timely safety information to airport operators for runway surface maintenance and to revise the advisory circular.

The contract effort will involve approximately 270 airports. These are airports that are in the airport certification program, ILS-equipped, and provide service to turbojet aircraft. The first phase of the contract, a testing procedure evaluation phase, began on September 29, 1978, and was completed on June 26, 1979. It involved 28 airports. The second phase began on May 10, 1979, and when it is completed (October 1980), the runways used by air carrier aircraft at all 270 airports will have had two or three friction and pavement condition surveys.

To date, we have realized several findings from the contract effort:

- The friction measuring device, the Mu Meter, has shown that it is reliable and provides repeatable results representative of runway friction characteristics.

- The predetermined field survey schedule can be reasonably accomplished within the time limits imposed.

- The types and volume of the data acquired in the program are appropriate for effective statistical analysis, essential to any project in making meaningful determinations.

- During the phase I effort, it was realized that the water depth (universally accepted at that time as 0.02 inches) was not adequate to cover all textured surfaces measured in the program. An evaluation determined that it should be changed to 0.04 inches to represent a more realistic rainfall rate of one inch per hour.

- The data collected on an individual runway usually showed a pattern associated with rubber accumulation. It was observed that dry mu values on most runway surfaces were relatively constant and at high levels throughout the runway length regardless of rubber accumulation; whereas, wet mu values tended to drop quite dramatically in areas of significant rubber accumulation.

- Runway grooving and porous friction course overlays provided the most consistent mu values and drainage characteristics.

- The frequency of surveys at airports still is under study to determine how often surveys should be conducted.

We believe the alternative actions taken by the FAA fulfill the intent of the above recommendations.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

DEPARTMENT OF TRANSPORTATION
FEDERAL-AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

APR 10 1978

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

In response to Acting Chairman Bailey's February 28 letter on Safety Recommendations A-76-136/137, we appreciate the recognition of our long-term surface treatment program as an acceptable action. We must, however, once again take exception to the recommendation of instituting regulatory action at this time on a runway coefficient of friction measuring program. Our objection to this recommendation is directed toward the economic and technological aspects of such action.

Economics: A universal requirement by rule for runway surface friction measurements would encumber some 500 airport operators and produce minimal or inadequate results. The purchase cost of the equipment alone to the individual airport operators would be in the neighborhood of $17.5 million. An additional responsibility for operations and maintenance costs would also be placed on each operator. A large majority of the potentially affected airports have a very limited employee force and, therefore, would be severely impacted. As the National Transportation Safety Board is aware, the 1976 amendments to the Airport and Airway Development Act provided for exemptions on economic grounds at approximately 80 percent of those airports at which fire fighting equipment requirements otherwise would apply. Also, we could expect determined resistance to a runway surface friction measuring requirement from some of the affected segments of the aviation industry, thus making it extremely difficult, if not impossible, to accomplish program goals.

Technology: A number of precision techniques must be observed in the performance of these measurements and accuracy and reliability of results requires a uniform approach. There also is a need to collect and analyze data on a national basis to determine trends and to validate the criteria set forth in the advisory circular.

We, therefore, do not believe that the current implementation of the recommendations made by the Board would achieve the desired safety results.

To achieve immediate action on a much needed program, we have begun the preparation phase of a limited agency staffed runway surface friction measurement program. Agency funds, presently available, will be used to implement the initial program. It will begin with several measurements annually on those types of airports where the problem of hydroplaning is potentially greatest. Certificated airports that serve scheduled turbojet aircraft and are ILS equipped are those that we believe should have immediate attention. We believe the program should progress so that all runways served by scheduled air carriers will be measured, and that at such time as technological developments permit, further consideration should be given to instituting regulatory action that would transfer a portion of the responsibility for the program at busier airports to their operators.

The Federal Aviation Administration's approach will attain the mutually desired level of safety at airports. This will also obviate the need for a regulation which in our judgment would produce questionable results and would be found unacceptable by a large majority of airport operators.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Office of the
Chairman

National Transportation
Safety Board

Washington, D.C. 20591
February 28, 1978

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of December 6, 1977, concerning the Board's Safety Recommendations A-76-136 and 137, which proposed regulatory guidance and interim measures for pavement surface testing and maintenance.

We agree, as stated in our letter of November 4, 1977, that the long-term project to treat at least one runway at 224 airports serving turbojet aircraft is commendable and acceptable action. However, this action should be augmented by regulatory measures and interim methods outlined in Safety Recommendations A-76-136 and 137. Incorporating the guidelines of AC 150/5320-12 into 14 CFR 139 would greatly enhance the effectiveness of the extensive testing and research which has resulted in technical improvements in airport pavement design, construction, and maintenance. It appears that a logical follow-on to the runway surface treatment project at 224 airports would be the provision of suitable regulatory guidelines which would assure consistent procedures for pavement testing, treatment, and maintenance.

Thus, while our staff is available to meet with your staff on this or any other subject of safety concern at any time, in view of the urgent safety considerations involved in this subject, we do not believe that action by the FAA should be deferred pending any such meeting.

Sincerely yours,

Kay Bailey

Kay Bailey
Acting Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20590

OFFICE OF
THE ADMINISTRATOR

DEC 6 1977

Honorable Kay Bailey
Acting Chairman, National Transportation
Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594

Dear Miss Bailey:

This is an interim response to your letter of November 4 on Safety Recommendations A-76-136/137 which we read with considerable interest. In the Quarterly National Transportation Safety Board (NTSB)/Federal Aviation Administration (FAA) coordination meetings on this subject of March 9 and July 6, your technical staff was, we believe, thoroughly briefed on the progress of our initially proposed plan contained in the February 15 response to the recommendations. As reflected in the minutes of the July 6 meeting, copy enclosed, the NTSB will keep recommendations open. The alternative action was considered acceptable pending the results of FAA initiatives.

The application of these recommendations is complex and has a significant impact on the aviation community. We propose that there be a meeting between FAA and the Board and/or its Technical staff to discuss in detail the ramifications of your recommendations and the Agency's actions. If you agree that such a meeting would be beneficial, we will provide you with a final reply after the meeting.

Sincerely,

Quentin S. Taylor
Deputy Administrator

Enclosure

Office of Chairman

National Transportation Safety Board

Washington, D.C. 20594

November 4, 1977

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Department of Transportation
800 Independence Avenue S.W.
Washington, D.C. 20591

Dear Mr. Bond:

On November 18, 1976, the National Transportation Safety Board forwarded Safety Recommendations A-76-136 and 137 proposing regulatory requirements for the maintenance and testing of paved runway surfaces.

It was recommended that until such time as these regulatory requirements are established, friction surveys, as outlined in Chapter 5 of Advisory Circular 150/5320-12, be conducted on all runways certificated under 14 CFR 139, and appropriate corrections be made if unsafe surface conditions exist. It was further recommended that timely cautionary notices, such as NOTAMS, should be issued if immediate corrections cannot be made and operational considerations dictate continued use of the runway.

We commend your staff for initiating actions outlined in your letter of February 15, 1977, particularly the proposed treatment within a 3-year period of at least one runway which had no surface treatment at each of the 224 airports used by turbojet aircraft.

While this type of action is certainly positive and acceptable from a long-range viewpoint, the Safety Board cannot accept the Federal Aviation Administration's position in not intending to make friction measurements a regulatory requirement because of insufficient standards and authentic guidance material.

The Safety Board finds that your Advisory Circular 150/5320-12 is an excellent document for providing guidance material and standards and has stated this position previously in the text of Safety Recommendations A-76-136 and 137.

While we are fully cognizant of some of the difficulties in implementing the proposed regulations, we are not inclined to condone the risk of a compromise of safety in airport operations by allowing the possible existence of undetected and unacceptable runway surface friction levels.

We are looking forward to an early and positive response.

Sincerely yours,

Francis H. McAdams

for Kay Bailey
Acting Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

February 15, 1977

Honorable Webster B. Todd, Jr.
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-76-136 and 137.

We have determined on a priority basis runways in the air carrier system where the potential for hydroplaning exists. Initially, we have identified 224 airports which have precision approach systems and serve turbojet airplanes but do not have any form of runway surface treatment.

We have requested Regional Directors to establish a high priority for runway surface treatment to enhance safety in this area. The locations having the greatest potential for slippery conditions will be identified. The airport owners will be advised of the importance and urgency of accomplishing runway surface improvement. FAA technical and financial assistance will be explained and additional guidance provided, setting forth the benefits to safety from the various types of surface treatments.

It is our objective that within a three-year period at least one runway at each of the 224 airports will be treated.

We have also scheduled a meeting with industry representatives and consumer groups on February 23 to discuss ongoing programs, future programs and new approaches to reduce runway slipperiness. From this meeting we hope to ascertain other appropriate courses of action to be taken regarding the improvement of runway surfaces.

We do not intend to make friction measurement a regulatory requirement at this time because of insufficient standards and authentic guidance material. However, if the programs now underway do not progress satisfactorily, we will again consider the possibility of regulatory action.

Sincerely,

Jeff Cochran

J. W. Cochran
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

FOR RELEASE: 6:30 A.M., E.S.T., NOVEMBER 18, 1976
(202) 426-8787

ISSUED: November 18, 1976

Forwarded to:

Honorable John L. McLucas
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)
A-76-136 and 137

During recent investigations of incidents involving inability to stop aircraft on the runway, the National Transportation Safety Board has found that the frictional characteristics of some runway surfaces have not been maintained sufficiently to provide effective braking action; this is particularly true for surfaces in the touchdown zones of runways during wet runway conditions.

The Safety Board believes that such conditions pose a serious hazard for emergency takeoff aborts at high gross weights when the last 1,000 to 1,500 feet of runway are required to stop safely.

We have reviewed Advisory Circular 150/5320-12 and found this to be an excellent document, particularly the sections outlining procedures for "maintenance of pavement surfaces" and "Airport Management Responsibility." In reviewing 14 CFR 139.83 and 139.91, we find that there are basic regulatory requirements for the maintenance and inspection of paved areas, but there are no regulatory guidelines or well-defined standards for compliance with these regulations. Since Advisory Circular 150/5320-12, Chapters 4 and 5, provide critical data for adequate maintenance of paved surfaces and a specific outline for airport management responsibility, the Safety Board recommends that:

> All portions of AC 150/5320-12 applicable to the testing and maintenance of paved runway surfaces be required as a condition for continuous certification of all airports utilized by turbine-powered air carrier aircraft, and be incorporated into 14 CFR 139. (Class II--Priority Followup.)(A-76-136).

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A-76-136 and 137

Until such time as the above provisions of AC 150/5320-12 are made mandatory, require that periodic friction surveys, as outlined in Chapter 5 of AC 150/5320-12, be conducted on all runways certificated under 14 CFR 139. Also require that appropriate corrections be taken if unsafe surface conditions exist or that timely cautionary notices, such as NOTAMS, be issued if immediate corrections cannot be made and operational considerations dictate continued use of the runway. (Class I--Urgent Followup.)(A-76-137).

TODD, Chairman, BAILEY, Vice Chairman, McADAMS, HOGUE, and HALEY, Members, concurred in the above recommendations.

By: Webster B. Todd, Jr.
Chairman

THESE RECOMMENDATIONS WILL BE RELEASED TO THE PUBLIC ON THE ISSUE DATE SHOWN ABOVE. NO PUBLIC DISSEMINATION OF THE CONTENTS OF THIS DOCUMENT SHOULD BE MADE PRIOR TO THAT DATE.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 17, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to Safety Recommendation A-77-16 issued April 20, 1977, and supplements our letter of October 22, 1979. This also responds to your letter of July 28, 1980, in which you requested an updated status report.

A-77-16. Amend 14 CFR 139.45 to require, after a reasonable date, that extended runway safety area criteria be applied retroactively to all certificated airports. At those airports which cannot meet the full criteria, the extended runway safety area should be as close to the full 1,000-foot length as possible.

FAA Comment. The reasons for nonconcurrence in this recommendation were stated in our letter of July 11, 1977. Our position of nonconcurrence with the requirement to apply safety and extended runway safety area criteria to all certificated airports remains unchanged. We are considering an amendment to FAR Part 139, however, which will require extended safety areas for all runways used by air carriers with any proposed major airport construction. The amendment has not, as yet, been published as a Notice of Proposed Rulemaking (NPRM), and there is no assurance, therefore, that we will proceed with a final rule.

As stated in our letter of October 22, 1979, changes to Advisory Circular (AC) 150/5335-4, Airport Design Standards - Airports Served by Air Carriers - Runway Geometrics, dated July 21, 1975, have been distributed (copy enclosed). Please note that this consolidated reprint incorporates Changes 1 and 2, which were effective June 11, 1980. This AC, although advisory, places more emphasis on extended safety areas. This subject is addressed on page 18, paragraph 17, and recent changes are reflected in subparagraphs a. and b.

Assuming that we publish an NPRM and the comments and our analysis are such that we proceed with final rulemaking, we estimate completion during calendar year 1981. We will inform the Board when rulemaking is completed, or of the reasons why rulemaking has been deemed unnecessary.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

National Transportation Safety Board

Washington, D.C. 20594

July 28, 1980

Office of Chairman

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to your letter dated October 22, 1979, concerning the status of National Transportation Safety Board Safety Recommendation A-77-16 issued April 20, 1977. This is one of two recommendations that emanated from our investigation of a Texas International Airlines DC-9 accident at the Stapleton International Airport, Denver, Colorado, on November 16, 1976. The aircraft overran the runway during a rejected takeoff. Our recommendation dealt with extended runway safety area criteria.

Your letter indicated that a Notice of Proposed Rule Making to amend FAR Part 139 was scheduled for publication in the Federal Register in late 1979. In order to evaluate the progress of this recommendation and update the public docket, the Safety Board would appreciate an updated status report.

Sincerely yours,

James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20591

Office of the Chairman

July 27, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to National Transportation Safety Board recommendation A-77-16 issued April 20, 1977. This is one of two recommendations that stemmed from our investigation of the Trans International Airlines DC-9 accident at the Stapleton International Airport, Denver, Colorado, on November 16, 1976. The aircraft had overrun the runway during a rejected takeoff.

We recommended that the Federal Aviation Administration (FAA):

> Amend 14 CFR 139.45 to require, after a reasonable date, that extended runway safety area criteria be applied retroactively to all certificated airports. At those airports which cannot meet the full criteria, the extended runway safety area should be as close to the full 1,000-foot length as possible.

The FAA's response of July 11, 1977, indicated that an amendment to Part 139 would be proposed to require extended safety areas in order to meet the criteria of Advisory Circular 150/5335-4 where practicable. Our staff advises us that action has been delayed because of other FAA priorities. We would appreciate your advice as to the status of this recommendation.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

October 22, 1979

Honorable James B. King
Chairman
National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D. C. 20591

Dear Mr. Chairman:

This is in response to your letter of July 27 regarding the status of National Transportation Safety Board Recommendation A-77-16:

> "Amend 14 CFR 139.45 to require, after a reasonable date, that extended runway safety area criteria be applied retroactively to all certificated airports. At those airports which cannot meet the full criteria, the extended runway safety area should be as close to the full 1,000-foot length as possible."

Our position of nonconcurrence with the recommendation to require retroactive application of safety and extended runway safety area criteria to all certificated airports, as stated in our letter of July 11, 1977, remains unchanged. The proposed amendment to FAR Part 139 to require extended safety areas at new airports, new runways, and major runway extensions at existing airports has not, as yet, been published as a Notice of Proposed Rule Making (NPRM). The NPRM is scheduled to be completed and ready for publication in the Federal Register in late 1979.

A change to Advisory Circular 150/5335-4 has been prepared and was distributed on March 5. This AC, although advisory, now places more emphasis on extended safety areas.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

December 20, 1977

Honorable Kay Bailey
Acting Chairman, National
Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Miss Bailey:

This is in response to your letter of November 4 expressing the Board's concern that the funding level for the retrofit of approach light system structures with frangible materials and fittings is inadequate and will cause a delay beyond the 3 to 5 year completion date included in safety recommendation A-77-17.

Our original estimate for the completion of the backfit program was $40 million as indicated in your letter. As indicated earlier, we are currently installing a prototype installation in Detroit, Michigan, using the new low-impact resistant structures. Considerable design effort has resulted in a structure that will cause minimal obstruction to aircraft while still maintaining the lights under strong wind, snow, and ice conditions. Additionally, we have found that to provide a clear approach area, we need to relocate the present regulator substations from the clear zone, provide maintainable structures, and minimize interference to electronic aids. These various factors, accompanied by a more detailed assessment of the individual site locations and anticipated future year costs, indicate that the total cost will be $77 million in contrast to the original $40 million estimate. We have currently contracted for value engineering services in an attempt to reduce the unit price of the low-impact resistant structures. We would not expect, however, to be able to reduce cost to the extent of program accomplishment within the original $40 million estimate.

As you are aware, the greatest portion of the facilities and equipment budget for FAA is devoted to various projects for the enhancement of safe and efficient movement of aircraft. We expect to concentrate our efforts in backfitting at airport locations with the highest exposure to

aircraft movements. With the current estimated cost, we feel that it will be difficult to accomplish the entire task within the desired 5-year time frame. With our efforts to reduce the unit installation cost and provide an emphasis for this program, we will endeavor to complete the major portion of it within the 5-year time frame, and the remainder in as short a time frame as possible thereafter.

Sincerely,

Quentin S. Taylor
Deputy Administrator

Office of Chairman

National Transportation Safety Board

Washington, D.C. 20594

November 4, 1977

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear Mr. Bond:

We have received your response to our safety recommendation A-77-17, which resulted from the Texas International accident at Stapleton International Airport, Denver, Colorado, on November 16, 1976.

The National Transportation Safety Board recognizes that funding for the retrofit of approach light system structures with frangible materials and fittings is contingent on the allocation of resources by Congress. However, we are aware that while the estimated cost of this program is about $40 million, to date $5.2 million and $3.9 million have been allocated for FY-77 and 78 respectively, and the budget request for FY-79 is $6 million. Based upon these amounts, and barring any reduction in the current level of funding, it appears that the completion date for the retrofit program necessarily is 7 to 9 years away.

The intent of our recommendation was to expedite the current ALS retrofit program, in order to complete the program within 3 to 5 years. We do not believe the current level of funding will accomplish this objective. In your response to the recommendation you stated that you are ... "fully cognizant of the importance of frangibility in ALS support structures to improve survivability in aircraft accidents in the vicinity of runway ends." In spite of the importance assigned to this program, we believe that it carries a low priority considering the projected completion date. We urge you to take action which will increase the priority and funding allocation of this program to meet a 3 to 5 year completion date.

Sincerely yours,

Francis H. McAdams

for Kay Bailey
Acting Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

July 11, 1977

Honorable Webster B. Todd, Jr.
Chairman, National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to the National Transportation Safety Board (NTSB) recommendations resulting from the Texas International accident at Stapleton International Airport, Denver, Colorado. The following comments and actions to the recommendations are provided:

A-77-16: Amend 14 CFR 139.45 to require, after a reasonable date, that extended runway safety area criteria be applied retroactively to all certificated airports. At those airports which cannot meet the full criteria, the extended runway safety area should be as close to the full 1,000-foot length as possible.

NONCONCUR: Advisory Circular 150/5335-4 provides the criteria for runway geometric design for airports served by certificated route air carriers. The design guidance contained in this Advisory Circular is intended for new airports and is applicable to existing airports to the extent practical and feasible. Extended safety areas at all existing certificated airports would be impractical and infeasible from the standpoint of placing an unreasonable economic burden on the airport operators.

We will propose an amendment to Part 139 that will require extended safety areas concurrently with construction of new airports, new runways, and major runway extensions at existing airports. The establishment of full extended safety areas (200-foot runway safety area and 800-foot extended safety area), or any portion thereof, would be contingent upon the geography of the airport and the availability of airport property. The target date for submitting a project report for developing a Notice of Proposed Rulemaking (NPRM) to announce this proposal is December 1977.

A-77-17: Expedite the retrofit of ALS structures with frangible materials and fittings by allocating additional fundings or by increasing the priority of the existing program so that it can be completed within three to five years.

<u>CONCUR:</u> The FAA is fully cognizant of the importance of frangibility in ALS support structures to improve survivability in aircraft accidents in the vicinity of runway ends. Since the inclusion of Navaids as an eligible item of airport development under the Airport and Airway Development Act of 1970, our criteria has stipulated frangible structures for the approach lighting system. Construction using this criteria has been accomplished under this program since 1973 at numerous locations. We have been installing low impact resistance structures in all new Medium Approach Lighting Systems (MALS) since 1975 in the agency's Facilities and Equipment Program and plan to continue the program in the future. A prototype design has been completed for Approach Lighting System with Flasher (ALSF) installations and is presently being installed at Detroit, Michigan. While we have no assurance that the retrofit program can be completed within the three to five year timeframe recommended, we are implementing the program as rapidly as resources allocated by the Congress and other demands placed on the agency permit.

An amendment to Part 139 is presently being developed in the Office of Chief Counsel that will clarify the requirement that all objects located in any safety area will be on frangible mounted supporting structures. Target date for publishing the NPRM for this amendment is February 1978.

Sincerely,

Quentin S. Taylor
Deputy Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 20, 1977

Forwarded to:

Honorable Quentin S. Taylor
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-77-16 and 17

On November 16, 1976, Texas International Airlines Flight 987, a McDonnell Douglas DC-9-14, ran off the end of runway 8R during an aborted takeoff at Stapleton International Airport, Denver, Colorado. The aircraft's structure was damaged when the left landing gear collapsed. Structural damage to the left wing caused fuel to leak and feed the fire that erupted on the left side of the fuselage.

The National Transportation Safety Board's investigation of the crash revealed that most of the damage to the aircraft was caused by (1) two ditches -- one 18 inches deep and the other 3 feet deep -- which traversed an area within 1,000 feet of the end of the runway; and (2) the nonfrangible steel structures supporting the approach light system (ALS). The aircraft sustained the most damage within the first 1,000 feet beyond the departure end of runway 8R. The Safety Board believes that, had this area been free of ditches and had the ALS structures been constructed of frangible materials, the aircraft would have sustained significantly less structural damage. Furthermore, the likelihood of fire would have been greatly reduced.

The FAA has recognized the value of an extended runway safety area at airports served by air carriers for several years. However, the criteria are mandatory only at certificated airports which have been constructed recently. We believe that the extended runway safety area increases the level of safety for an aircraft which undershoots or overruns the runway, and we believe that the criteria for the extended runway safety area should be mandatory at all certificated airports, regardless of the date of construction. When the geography of an airport or the availability of airport property will not allow the full 1,000-foot area, the extended runway safety area should be as close to the criteria as possible. At Stapleton International Airport, the land is available for a 1,000-foot safety area, but the safety area has not been established as recommended in AC 150/5335-4.

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Examination of the wreckage revealed that pieces of the ALS structures severed the left outer wingtip. The concrete support structures had been pulled out of the ground. In contrast, the first ALS structure, which had frangible fittings, broke off at the base and caused virtually no damage to the aircraft. During the Eastern Airlines B-727 accident at John F. Kennedy International Airport, June 1975, nonfrangible ALS structures also compounded the severity of the aircraft damage. The Safety Board is aware that the FAA has a retrofit program for the installation of frangible ALS structures. The Safety Board believes this to be a very significant program, which has the potential to provide an important safety advantage at those airports where it has been implemented. Accordingly, the Safety Board believes that the retrofit program should be given a priority to assure that it can be completed in 3 to 5 years.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend 14 CFR 139.45 to require, after a reasonable date, that extended runway safety area criteria be applied retroactively to all certificated airports. At those airports which cannot meet the full criteria, the extended runway safety area should be as close to the full 1,000-foot length as possible.
> (Class III, Longer Term Followup) (A-77-16)

> Expedite the retrofit of ALS structures with frangible materials and fittings by allocating additional fundings or by increasing the priority of the existing program so that it can be completed within 3 to 5 years.
> (Class II, Priority Followup) (A-77-17)

TODD, Chairman, BAILEY, Vice Chairman, McADAMS, HOGUE, and HALEY, Members, concurred in the above recommendations.

Kay Bailey

By: Webster B. Todd, Jr.
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

June 15, 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Please refer to the Federal Aviation Administration's (FAA) letter dated April 7, 1981, further responding to National Transportation Safety Board Safety Recommendation A-78-1 issued February 14, 1978. This recommendation stemmed from our investigation of the Southern Airways DC-9 accident at New Hope, Georgia, on April 4, 1977. We recommended that the FAA:

> Initiate research to determine the attenuating effects of various levels of precipitation and icing on airborne radomes of both x- and c- band radar, and disseminate to the aviation community any data derived concerning the limitations of airborne radar in precipitation.

We are pleased to note that a joint FAA/NASA study will be conducted to determine the effects of precipitation on airborne radomes, and that this study will be followed by flight tests if deemed necessary. We thank the FAA for this responsive action and the offer to keep us informed of significant progress as the program continues. Safety Recommendation A-78-1 is classified in an "Open--Acceptable Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

April 7, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-78-1 issued February 14, 1978, and supplements our letter of July 20, 1979. This also responds to your letter of July 28, 1980, in which you requested an updated status report.

A-78-1. Initiate research to determine the attenuating effects of various levels of precipitation and icing on airborne radomes of both x- and c- band radar, and disseminate to the aviation community any data derived concerning the limitations of airborne radar in precipitation.

FAA Comment. Funding has been approved through the Federal Aviation Administration (FAA) Technical Center in the amount of $25,000 to fund a joint FAA/NASA study expected to culminate in a flight test later this summer. The NASA-Langley Research Center's Flight Electronics Division is fabricating instrumentation for test utilizing a radome for the FAA/NASA T-39 research aircraft. Assuming static ground tests show that measurement of a water layer can be made, flight testing will be conducted at Edwards Air Force Base, California, using a KC-135 water spray tanker with the T-39 in formation flight behind.

This project effort, entitled "Assessment of the Existence of Water Layers on Airborne Radomes During Flight in Precipitation," is outlined in the preliminary test plan (copy enclosed). Please note that the procurement and fabrication phase is scheduled for completion in mid-April 1981, with flight testing scheduled to take place in mid-summer. We plan to have usable data available by early autumn of 1981.

We will keep the Board informed of significant progress in this area as our program continues.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

National Transportation Safety Board

Washington, D.C. 20594

July 28, 1980

Office of
Chairman

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to the Federal Aviation Administration's (FAA) letter of July 20, 1979, concerning National Transportation Safety Board Safety Recommendation A-78-1. The recommendation stemmed from the Southern Airways DC-9 accident at New Hope, Georgia, on April 4, 1977, and pertained to the attenuating effects of various levels of precipitation and icing on airborne radomes.

Your letter indicated that the FAA was reviewing the basis of its April 9, 1979, response, and that the Safety Board would be advised in the near future. In order to evaluate the progress of this recommendation, we would appreciate an updated status report.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

JUL 20 1979

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

On April 9, 1979, we reported to the Board on the status of the Federal Aviation Administration's (FAA) actions in response to NTSB Safety Recommendation A-78-1 related to research to determine the attenuating effects of various levels of precipitation and icing on airborne radomes and the dissemination of data to the aviation community. We stated that the attenuation effects of ice and water are well known and that we do not believe that research is necessary.

The Board responded on June 7 providing the rationale for its belief that the actual extent of attentuation due to precipitation on airborne radomes should be determined, and suggesting that FAA further consider the matter.

This matter was discussed briefly during the NTSB/FAA quarterly meeting held July 13. FAA offered to review the basis for our April 9 response.

We will advise the Board in the near future as to the results of the review.

Sincerely,

for CHARLES R. FOSTER
Associate Administrator
for Aviation Standards

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

June 7, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to the Federal Aviation Administration's (FAA) letter of April 9, 1979, in response to our March 14, 1979, letter concerning the status of National Transportation Safety Board recommendation A-78-1 relevant to the Southern Airways DC-9 (SO242) accident at New Hope, Georgia, on April 4, 1977. The Safety Board recommended that the FAA initiate research to determine the attenuating effects of various levels of precipitation and icing on airborne radomes of both x- and c- band radar, and that any pertinent data be disseminated to the aviation community. The FAA's response indicates that FAA has no evidence of serious problems caused by ice and water on radomes, that the attenuation effects of ice and water are well known, and that further research is not necessary.

Events surrounding SO242's flight suggest that the contour function of the airborne radar was degraded. If the radar were working properly and the control settings were correctly made by the crew, we believe that attenuation would very likely explain the degraded radar signals or faulty contour. One of the findings in the National Transportation Safety Board's report of this accident indicates that the captain's decision to penetrate the storm area was based on his interpretation of the weather radar display; his reliance on that display was considered to be a major factor contributing to the accident.

As you indicated in your letter, the effects of attenuation by rainfall and water vapor between the radome and the target are well known. A number of studies have provided a basis for calculating such attenuation effects with reasonable assurance of accuracy. However, we believe this may comprise only part of the attenuation problem. Before issuance of this recommendation, our staff consulted informally on this subject with several widely recognized radar meteorologists and airborne radar and radome manufacturers. All agreed that precipitation on the radome would result in some type of attenuation, but there was no consensus on the extent of that attenuation. Some offered opinions which varied from "probably not much"

to "considerable, especially when near freezing level with partially frozen precipitation." Therefore, we would agree that the "attenuation effects of ice and water are well known" if one considers only attenuation which occurs after the signal has left the radome; but the effects of precipitation, if any, on the radome itself are not well known.

Preliminary results of a recent study conducted by the National Severe Storms Laboratory indicate that rainfall attenuation of x-band radar is greater than c- band by several orders of magnitude, and that x- band attenuation causes loss of high reflectivity areas.

Because of the extensive use of x- band radar, and the fact that many decisions to avoid thunderstorms--particularly by local service carriers operating on short flights--are made while aircraft are operating in precipitation conditions, radar display interpretation becomes critical.

As a result of the limitations of current air traffic control surveillance radar and the present system for relaying severe weather information to airborne flightcrews, the controller can be of little assistance before he receives confirmation of severe weather from the flightcrew; and they, in turn, must rely almost exclusively on airborne weather radar. But if the crew's interpretation of the radar display is made without knowledge of the extent to which attenuation can adversely affect the presentation, there is no assurance that severe weather ahead can be detected and avoided. Accordingly, because of the potential catastrophic consequences of inadvertent aircraft penetration of severe weather, we continue to believe that the actual extent of attenuation due to precipitation on airborne randomes should be determined.

We are holding safety recommendation A-78-1 in an "Open--Unacceptable Action" status pending your further consideration of this matter.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 9, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to your letter of March 14 which requests the status of Federal Aviation Administration actions with respect to National Transportation Safety Board Safety Recommendation A-78-1.

A-78-1. Initiate research to determine the attenuating effects of various levels of precipitation and icing on airborne radomes of both x- and c- band radar, and disseminate to the aviation community any data derived concerning the limitations of airborne radar in precipitation.

Comment. Our letter of April 17, 1978, indicated that extensive research might not be necessary. We stated that we would review data gathered with the assistance of the Air Transport Association and decide on courses of action.

Review of the data has been completed. Experience with the earlier heated radomes revealed much poorer performance than those which were not heated. Icing has not been a problem since radome heating was generally discontinued. The older honeycomb core delivered before 1962 had some problems with trapped moisture from condensation which alternately froze and thawed with ground to cruising altitude cycles. Those which remain in service are maintained by special procedures which include periodic moisture checks using a moisture register and complete drying in the shop before return to service. The later type radomes use a fluted type honeycomb which is self-draining.

We do not have evidence of serious problems caused by the accumulation of ice and water on radomes.

The attenuation effects of ice and water are well-known. We do not believe that research is necessary.

To ensure that air carrier training programs are satisfactory in this area, we will request that each Principal Operations Inspector check the training program of his assigned carrier to ensure that all pilots are being given information on the limitations of airborne weather radar with special emphasis on the attenuation effects of precipitation. We plan to issue the request to Principal Operations Inspectors within the next 30 days.

With respect to the dissemination of the information to the aviation community, we expect to issue an advisory circular and an operations bulletin within the next 90 days.

We will advise you when these actions have been completed.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Office of the
Chairman

**National Transportation
Safety Board**

Washington D.C. 20594

March 14, 1979

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to the National Transportation Safety Board recommendation A-78-1 issued February 14, 1978. This recommendation stemmed from the Southern Airways DC-9 thunderstorm accident at New Hope, Georgia, on April 4, 1977. The Safety Board proposed that the Federal Aviation Administration (FAA) initiate research to determine the attenuating effects of precipitation and icing on airborne radomes and to disseminate to the aviation community the limitations of airborne radar in precipitation.

The FAA's response of April 17, 1978, indicated that research may not be necessary since a large portion of the data needed was already available. The Safety Board would be pleased to know whether the FAA has reviewed the data and decided on a course of action for dissemination of this information to the aviation community.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

APR 17 1978

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-78-1.

A-78-1. Initiate research to determine the attenuating effects of various levels of precipitation and icing on airborne radomes of both x- and c- band radar, and disseminate to the aviation community any data derived concerning the limitations of airborne radar in precipitation.

Comment. Preliminary information indicates that extensive research may not be necessary. Comments made at the Aeronautical Radio Incorporated Weather Radar Meeting on March 7 indicated that a large portion of the data needed is already available in the aviation community.

We have requested the assistance of the Air Transport Association in gathering these data. Compilation is expected to be completed within 90 days. We will review the data and decide on a course of action for dissemination of available information and for obtaining any needed additional information.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 14, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-78-1

On April 4, 1977, Southern Airways, Inc., Flight 242, a DC-9-31, crashed at New Hope, Georgia, as its crew attempted an emergency landing on a highway. The National Transportation Safety Board's investigation disclosed that the flight had entered an intense precipitation area which resulted in the failure of both of the aircraft's engines.

Southern 242 departed Huntsville, Alabama, in precipitation and, as closely as can be determined, was in precipitation until after it encountered the intense portion of the thunderstorm and "lost" both engines. Evidence suggests that when the aircraft was in the vicinity of the intense portion of the storm the crew did not identify correctly contour information on their radar display although it appeared to have been operating to their satisfaction. Evidently, the crew was either presented an erroneous radar display, or they both misinterpreted the display. Considering the level of experience and qualifications of this crew, the Safety Board believes that they most likely were receiving a radar signal which was attenuated by the precipitation in which the flight was conducted. Attenuation, which can result from ice or rain on the radome or from precipitation ahead of the radome, can weaken a signal which, in turn, reduces contour capability.

The Safety Board recognizes that studies comparing airborne radar with ground-based radar have concluded that the precipitation attenuation of airborne radar, due to precipitation ahead of the radar, should "not prevent its use for storm avoidance." However, the studies did not consider the effects of rain or ice on the radome. Consequently, the Safety Board concludes that a study should be made to determine the extent of attenuation caused by rain and ice on airborne radomes and that information derived from this study which is pertinent to the limitations of airborne weather radar equipment should be disseminated to the aviation community.

2059F

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Initiate research to determine the attenuating effects of various levels of precipitation and icing on airborne radomes of both x- and c- band radar, and disseminate to the aviation community any data derived concerning the limitations of airborne radar in precipitation. (Class II-Priority Action) (A-78-1.)

BAILEY, Acting Chairman, McADAMS, HOGUE, and KING, Members, concurred in the above recommendation.

Kay Bailey

By: Kay Bailey
Acting Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

MAY - 7 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

This is to acknowledge the Federal Aviation Administration's (FAA) letter of April 10, 1981, further responding to National Transportation Safety Board Safety Recommendation A-78-20 issued April 6, 1978. This is one of three recommendations made as a result of several fatal crashes that occurred when pilots became trapped in canyons while attempting to cross mountain pass routes. Companion recommendations A-78-18 and -19 are in a closed status.

In Safety Recommendation A-78-20 we requested the FAA to:

> Depict on all applicable sectional charts the altitude of mountain passes in a manner that avoids confusion with the critical elevation information. This altitude information should be presented in a manner that may be easily associated with the depiction of mountain pass routes.

We are pleased to note that the FAA and Interagency Air Cartographic Committee (IACC) have agreed to increase the size of the mountain pass symbol and will indicate the type of pass elevation next to the symbol. This action complies with the intent of the recommendation which we now classify in a "Closed--Acceptable Alternate Action" status.

We thank the FAA and IACC for actions taken.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 10, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to your letter of September 24, 1980, regarding NTSB Safety Recommendation A-78-20 issued April 6, 1978. Safety Recommendation A-78-20 is one of three recommendations issued to the Federal Aviation Administration (FAA) on April 6, 1978. Safety Recommendation A-78-18 was classified as "Closed--Acceptable Action," and A-78-19 was classified as "Closed--Acceptable Alternate Action" by official Board action on February 5, 1979.

A-78-20. Depict on all applicable sectional charts the altitude of mountain passes in a manner that avoids confusion with the critical elevation information. This altitude information should be presented in a manner that may be easily associated with depiction of mountain pass routes.

FAA Comment. As stated in our earlier correspondence, the FAA submitted a proposal to the Interagency Air Cartographic Committee (IACC) in response to Safety Recommendation A-78-20. This proposal was to increase the size of the existing mountain pass symbol ")(" and to box the pass elevation to differentiate between pass elevations and critical elevations. After thorough evaluation of this proposal, it was determined that increasing the size of the pass symbol and properly placing the pass elevation type adjacent to the symbol would be a more appropriate solution. This alternative is in the process of being implemented.

We believe our action satisfies the intent of Safety Recommendation A-78-20 and, accordingly, the FAA considers action on this recommendation completed.

Sincerely,

Charles E. Weithoner
Acting Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of
Chairman

September 24, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Please refer to your letter dated November 16, 1978, and the National Transportation Safety Board's response of February 5, 1979, regarding Safety Recommendation A-78-20. We recommended that the Federal Aviation Administration:

> "Depict on all applicable sectional charts the altitude of mountain passes in a manner that avoids confusion with the critical elevation information. This altitude information should be presented in a manner that may be easily associated with the depiction of mountain pass routes."

Your letter indicated that a proposal had been submitted to the Interagency Air Cartographic Committee for implementation. In order to evaluate the status of this recommendation and update the public docket, we request your confirmation of completed action.

Sincerely yours,

James B. King

James B. King
Chairman

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

February 5, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to your letter of November 16, 1978, relating to safety recommendations A-78-18 through 20. These recommendations were made as a result of several fatal crashes that occurred when pilots became trapped in canyons while attempting to cross mountain pass routes.

Recommendation A-78-18

We are pleased that an appropriate caution note has been added to the Center Basin Canyon on the San Francisco Sectional Chart indicating dangerous terrain. The status of this recommendation is now classified as "Closed - Acceptable Action."

Recommendation A-78-19

We note the following responsive actions.

1. The Kearsarge Pass mountain route between Fresno and Independence, California, has been removed from the San Francisco Sectional Chart.

2. A special notice has been placed in the Airman's Information Manual concerning avoidance of the East/West mountain pass route between Fresno and Independence.

3. An educational article on the safety aspects of mountain flying appeared in the August 1978 issue of FAA General Aviation News.

The status of this recommendation is now classified as "Closed - Acceptable Alternate Action."

Recommendation A-78-20

We note that a proposal has been submitted to the Interagency Air Cartographic Committee (IACC) to fulfill this recommendation, which has now been placed in an "Open - Acceptable Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

November 16, 1978

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to your October 5 letter concerning the Federal Aviation Administration's (FAA) action relating to NTSB Recommendations A-78-18 through 20.

Recommendation A-78-20. Depict on all applicable sectional charts the altitude of mountain passes in a manner that avoids confusion with the critical elevation information. This altitude information should be presented in a manner that may be easily associated with the depiction of mountain pass routes.

Comment. A proposal has been submitted to the Interagency Air Cartographic Committee (IACC) to depict mountain pass elevations on visual charts in a box located adjacent to the pass symbol. The symbol size used to depict mountain passes will be increased and the chart legend will be modified to indicate that boxed elevations represent the elevation of mountain passes.

We believe that the above actions will prevent any confusion between pass elevations and spot elevations.

In reference to NTSB Recommendations A-78-18 and 19, the November 2 San Francisco sectional chart has been amended as follows:

1. A caution note adjacent to the Center Basin Canyon is depicted.

2. The Kearsarge Pass mountain route between Fresno and Independence, California, has been removed.

We feel that Recommendations A-78-18 and 19 should be reclassified as closed, based on the above completed actions.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

5 OCT 1978

AOA#:	1042
ACTION/~~INFORMATION~~:	ASE-1
DUE DATE(S):	11/29/78
FOR SIGNATURE OF:	AOA-1
COORDINATION WITH/THRU:	
INFORMATION COPY:	AOA-1/ADA-1

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear Mr. Bond:

This is to acknowledge Federal Aviation Administration (FAA) letters of June 19, 1978, and September 11, 1978, regarding safety recommendations A-78-18 through 20.

We are pleased that the FAA is taking positive action to depict the exact location of the Center Basin Canyon on the San Francisco Sectional Chart indicating dangerous terrain.

In addition, we commend FAA's action in putting a special notice in the Airman's Information Manual concerning avoidance of the East/West mountain pass route between Fresno and Independence, California; and we note the proposed alternate action to remove all mountain pass routes presently shown on visual navigation charts.

We consider these actions--when completed--and the excellent educational articles on the safety aspects of mountain flying in the August 1978 issue of FAA General Aviation News as fulfilling the intent of safety recommendations A-78-18 and 19. Accordingly, A-78-18 has been placed in an "Open-Acceptable Action" status and A-78-19 was classified as "Open-Acceptable Alternate Action," pending completion of the planned actions.

The FAA's response to A-78-20 indicating that charts will be reviewed to determine the clarity of depiction of the elevation of mountain pass routes is a logical first step, and we agree that such information should be clearly depicted. However, clarity of depiction would achieve only part of the intent of this recommendation. We also believe that depiction of the altitude of mountain passes should be conspicuously different from critical elevation values in order to avoid confusing these two types of information. Such depiction might necessitate the use of a different type style/size/color, or some other uniquely distinguishing characteristic.

In light of the above amplification of the intent of A-78-20 and FAA's responses, this recommendation has been classified as "Open-Unacceptable Action."

The Safety Board would appreciate being informed as to the results of your action on these matters.

Sincerely yours,

James B. King
Chairman

OCT 16 2 4- PM

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

September 11, 1978

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S. W.
Washington, D.C. 20594

Dear Mr. Chairman:

On April 6, 1978, the Safety Board issued Safety Recommendations A-78-18 through 20, calling for more detailed information about mountain pass routes to be depicted on sectional charts. In these recommendations the Board cited several fatal crashes which occurred when pilots became trapped in box canyons while attempting to cross mountain passes.

The FAA recognizes this hazard to VFR flying as a matter requiring a continuing safety education emphasis to instill pilot awareness.

The FAA General Aviation News, which has a current circulation of 69,000, has been an effective media for bringing such recurring as well as current safety matters to the attention of general aviation pilots.

In addition to the affirmative actions stated in the FAA's response letter of June 19, the August 1978 issue of FAA General Aviation News features safety aspects of mountain flying. Procedures and precautions for pilotage in mountainous regions stressed in these articles include areas pointed out in the Board's recommendations.

A copy of the August 1978 issue of FAA General Aviation News is presented for information and review relative to the Board's closing action on these recommendations.

Sincerely,

Quentin S. Taylor

Quentin S. Taylor
Deputy Administrator

Enclosure

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

June 19, 1978

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to safety recommendations A-78-18 through 20.

Recommendation A-78-18. Depict the exact location of the Center Basin Canyon on the appropriate sectional chart and label it in a manner that conveys its hazardous nature.

Comment. An appropriate caution note will be added to the Center Basin Canyon on the San Francisco Sectional Chart indicating dangerous terrain.

Recommendation A-78-19. Depict alternative mountain pass routes north and south of the Kings River Route on the appropriate sectional chart.

Comment. We do not concur. The FAA recently revised all visual charts by changing the previous Maximum Terrain Elevation Figure (MTEF) to a Maximum Elevation Figure (MEF). We are of the opinion that pilots should be prepared to fly above this figure to assure clearance of all obstacles and terrain. Any flight below MEF should be carefully planned and executed.

A special notice was put in the Airman's Information Manual, dated May 18, which recommends that pilots avoid use of the East/West mountain pass/route between Fresno and Independence, California, because of extremely hazardous terrain in proximity to this route.

In addition, a proposal to remove all mountain pass routes shown on visual navigation charts has been submitted to the aviation community. We plan to implement removal of such routes beginning in November 1978 with completion by April 1979.

Recommendation A-78-20. Depict on all applicable sectional charts the altitude of mountain passes in a manner that avoids confusion with the critical elevation information. This altitude information should be presented in a manner that may be easily associated with the depiction of mountain pass routes.

Comment. Sectional charts shall be reviewed to determine the clarity of depiction of elevation of mountain passes. Where data are not readily identified to such passes, charts will be revised at the normal time of chart update.

We feel these actions to be more appropriate than the recommendations, as we do not feel flight through canyons or mountain passes provides an adequate degree of safeguard. Any decision to conduct flights in this manner should be at the pilot's discretion.

Sincerely,

Quentin S. Taylor

Quentin S. Taylor
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 6, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-78-18 through 20

On November 26, 1977, a Piper single-engine aircraft, en route from Sunnyvale, California, to Las Vegas, Nevada, crashed 10 nautical miles southwest of Independence, California. The pilot and three passengers were killed.

The crash site was in a box canyon where three other fatal accidents had occurred within the previous 18 months. The intended route of flight in all four cases followed Kings River Canyon east from Fresno, California, to the Independence area. About 10 miles from the end of the depicted route, going west to east, a pilot must make a sharp turn to the north through narrow terrain in order to cross the pass. However, at this point the Canyon route appears to bear south into a larger or more open area. The incorrect route to the south leads to the Center Basin Canyon, a box canyon with sides as high as 13,977 feet.

As a result of previous accidents, and resultant interest from various parties, the Kings River Canyon route was depicted via the standard blue diamonds on the San Francisco Sectional Chart beginning with the November 3, 1977, edition. The Board understands that the intent of the depiction was to keep pilots from flying into the box canyon. However, as a result of our investigation of the November 26 accident, the Board believes that the exact location of the Center Basin Canyon should be depicted and labeled in such a manner that its hazardous nature will be recognized by a pilot.

Furthermore, the Board believes that when a mountain pass route is depicted, the maximum height of the pass should be depicted in a manner associated with the route. The Board believes that the present system of identifying the altitude of a mountain pass can be too easily confused with critical elevation information.

2314

The Board also believes that other popular mountain pass routes such as the pass west of Mammouth Lake and the pass east of Porterville, both north and south of the Kings River Route, should be depicted on the sectional chart. These routes can be flown at a lower altitude and would give an alternative for pilots planning a flight through a pass that accident records indicate as being hazardous.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Depict the exact location of the Center Basin Canyon on the appropriate sectional chart and label it in a manner that conveys its hazardous nature. (Class I-Urgent Action) (A-78-18)
>
> Depict alternative mountain pass routes north and south of the Kings River Route on the appropriate sectional chart. (Class I-Urgent Action) (A-78-19)
>
> Depict on all applicable sectional charts the altitude of mountain passes in a manner that avoids confusion with the critical elevation information. This altitude information should be presented in a manner that may be easily associated with the depiction of mountain pass routes. (Class I-Urgent Action) (A-78-20)

KING, Chairman, McADAMS, HOGUE, Members concurred in the above recommendation. BAILEY, Vice Chairman, did not participate.

James B King

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Thank you for your letter dated May 15, 1981, further responding to National Transportation Safety Board Safety Recommendation A-78-23 issued April 13, 1978. This is one of four recommendations that stemmed from our investigation of an Aerospatiale SA-318C Allouette II helicopter accident near Coldfoot, Alaska, on March 11, 1977. Companion Safety Recommendations A-78-24 through -26 have been resolved and their status classified as closed.

In Safety Recommendation A-78-23 we recommended that the Federal Aviation Administration (FAA):

> Expand its proposed research plans on "Cockpit Human Factors Problems," particularly in the area of Human Capabilities and Limitations and Displays and Controls, to include problems peculiar to helicopter controls and displays.

We note that the FAA is actively pursuing solutions to human factors problems associated with helicopters and will keep the Safety Board informed of significant progress in this area. The status of Safety Recommendation A-78-23 remains "Open--Acceptable Action."

Sincerely yours,

James B. King
James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

May 15, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-78-23 through A-78-26 issued April 13, 1978, and supplements our letter of June 27, 1978. This also responds to your letter of July 28, 1980, in which you requested an updated status report on Safety Recommendation A-78-23. Recommendations A-78-24 through 26 have previously been classified in a closed status by official Board action.

A-78-23. Expand its proposed research plans on "Cockpit Human Factors Problems," particularly in the area of Human Capabilities and Limitations and Displays and Controls, to include problems peculiar to helicopter controls and displays.

FAA Comment. Since our June 27, 1978, response to this safety recommendation, the Federal Aviation Administration (FAA) has been actively pursuing solutions to human factors problems associated with helicopters. FAA Systems Research and Development Service and the FAA Technical Center have completed efforts analyzing helicopter pilot workload in various flight situations. The FAA Technical Center is also currently involved in a helicopter accident analysis program to classify accidents caused by pilot factors.

In addition, FAA and the National Aeronautics and Space Administration are conducting cooperative programs to determine optimum/advanced helicopter display and integrated control systems for future design of helicopters. Finally, FAA is developing an overall human factors program to improve the man/machine interface of controllers and pilots in the National Airspace System. We have taken positive steps to include helicopters as part of this major effort.

As our work continues, FAA's Third Human Factors Workshop on Aviation was conducted at the Transportation Systems Center in Cambridge, Massachussets, on March 18 and 19, 1981, (copy of announcement enclosed). We will keep the Board informed of significant progress in the helicopter human factors area.

Sincerely,

J. Lynn Helms
Administrator

Enclosure

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

July 28, 1980

574
ACTION: ASF-1
DUE DATE(S): 9/5/80
FOR SIGNATURE OF:
COORDINATION WITH/THRU:
INFORMATION COPY: AVS-1/AOA-1
ADA-1

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

As a result of an Aerospatiale SA-318C Allouette II helicopter accident near Coldfoot, Alaska, on March 11, 1977, the National Transportation Safety Board, on April 13, 1978, issued four safety recommendations, A-78-23 through 26. Three of the safety recommendations, A-78-24 through 26, have been resolved and their status classified as closed. However, A-78-23 is in an "Open--Acceptable Action" status awaiting resolution. This recommendation called for the Federal Aviation Administration (FAA) to expand its proposed research plans on "Cockpit Human Factors Problems."

The FAA's response of June 27, 1978, indicated concurrence with this recommendation and plans to add helicopters to the "Cockpit Human Factors Program" in FY-1979. In order to evaluate the progress of this recommendation and update the public docket, we request an updated status report.

Sincerely yours,

James B. King
James B. King
Chairman

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OFFICE OF ADMINISTRATOR FEDERAL AVIATION ADMINISTRATION

JUN 27 1978

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-78-23 through 26.

A-78-23. Expand its proposed research plans on "Cockpit Human Factors Problems," particularly in the area of Human Capabilities and Limitations and Displays and Controls, to include problems peculiar to helicopter controls and displays.

Comment. We concur and plan to add helicopters to the "Cockpit Human Factors Program" in FY 1979.

A-78-24. Amend 14 CFR 133.23(c)(6) to require the pilot to demonstrate his ability to actuate the quick-release switch in normal and simulated emergency operations.

Comment. In addition to the quick-release device requirements of 14 CFR 133.43 and 27.865, 14 CFR 133.43 also requires a manual mechanical control for the quick-release device, readily accessible either to the pilot or a crewmember. The 14 CFR 133.41 requires an applicant for an external-load operations certificate to demonstrate maneuvering of the load into release position and the release, under flight operation conditions, by means of each of the quick-release controls. The quick-release device requirements and external-load operator crew training programs assure a quick-release capability.

While a thorough understanding of the load release mechanisms is necessary for a successful emergency release, there are elements of the operation where regulation does not appear to be appropriate. Of all the critical elements in an external-load emergency situation, one of the most important is the decision to release the load. The pilot's judgment is affected by his experience, his evaluation of a combination of factors, including the hazards to persons or property beneath the helicopter, and the nature of the load being transported. We do not believe that regulatory action in this area is appropriate nor justified by the evidence available at this time.

2

A-78-25. Issue an Advisory Circular advising rotorcraft external load operators that, whenever the cargo quick-release switch location or function on the pilot's primary control (usually the cyclic grip) is modified, the operators again have their pilots demonstrate their ability to actuate the switch in normal and simulated emergency operation without having to assume an unusual finger or thumb position which may induce unwanted control inputs.

Comment. We concur and plan to revise Advisory Circular AC 133-1, "Rotorcraft External-load Operations in Accordance with Federal Aviation Regulations Part 133," to include advising rotorcraft external-load operators that whenever the cargo quick-release switch location or function on the pilot's primary control is modified, the operators will have their pilots demonstrate knowledge of switch location and ability to operate it. We expect to issue this revision to Advisory Circular AC 133-1 by June 1979.

A-78-26. Delete 14 CFR 133.23(d) which permits the Administrator to waive pilot test of skill.

Comment. The granting of a waiver of the requirement for a test of pilot skill is based on the safety record of the operator. We do not believe amendment of 14 CFR 133.23(d) is necessary in the interest of safety. We do not plan to delete the waiver provisions from the rule.

Sincerely,

[Signed] Quentin S. Taylor
Acting Administrator

AFS-50:RTBoggs:do:x63120:6/20/78
cc: AOA-1/S-60/P-20/AI-1/ASF-1/AFS-1/APA-1/AFS-50/AFS-800/AEM-20
MC: AOA #370; AFS-9 #1007; ASF SUS: 6/12/78

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 13, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-78-23 through -26

On March 11, 1977, an Aerospatiale SA-31bC Allouette II helicopter was involved in an accident near Coldfoot, Alaska. The National Transportation Safety Board's investigation of the accident revealed a design feature of the cyclic grip which may compromise a pilot's ability to handle certain emergency situations.

The helicopter, which was hovering out of ground effect, attempted to lift two fuel drums from a pinnacle in a sling operation. The pilot tried to climb with this external load, but had unknowingly exceeded the helicopter's capabilities; the helicopter began to descend seconds after the drums cleared the ground. The drums rolled off the pinnacle and dragged the helicopter along. The pilot did not actuate the electric release button which would have jettisoned the load and probably would have averted the accident. The button was located at the top right side of the cyclic grip. The pilot stated that the button was situated in an awkward position on the cyclic and that he tried but was unable to actuate the release.

The Safety Board found that the operator of the helicopter had modified the cyclic grip of most of the other helicopters in his fleet by moving the electric quick-release function to a more accessible switch location on the top of the cyclic grip; however, this particular aircraft had not been modified. Thus, the pilot was flying the same type of helicopter with which he was familiar, but which had a different cargo quick-release switch location.

2300

The Safety Board has learned from Aerospatiale that three switches are located on the cyclic grip of the Allouette II helicopter, all with separate functions. We were informed that the cargo electric quick-release device can be wired to any of the three switch locations.

The different location of the quick-release switch could have created the problem encountered by this pilot. He instinctively would have relied on his past experience and training when he reacted to the emergency. He easily could have been confused as to the exact location of the electric quick-release switch on this particular helicopter. This problem is not unique to helicopters used in sling load operations; cyclic grip switch locations and functions differ on many helicopters and can be changed at the option of the operator.

Human error in the cockpit is a recognized safety problem in all types of aircraft. Safety Board statistics show that 74 percent of all fatal rotorcraft accidents during 1975 have been attributed in part to pilot-error. Our statistics revealed 19 accidents in the last 7 years in which "failure to jettison load" was cited as a factor or cause. Many general aviation accidents have been attributed to cockpit design features which provoke pilots into improperly using cockpit displays or controls. This problem also exists in helicopter crewstation design.

Design standardization on military helicopters is established by military specifications and standards. For instance, MIL-G-58087A (AV) details the design of the cyclic grip and component installations and the functions of switches on the cyclic grip. The Federal Aviation Administration (FAA), on the other hand, merely provides design minimums in order to provide manufacturers latitude in their designs. The regulations on sling load operations, specifically 14 CFR 133.43 and 14 CFR 27.865, only require that the quick-release switch "be designed and located so that it may be operated by the pilot without hazardously limiting his ability to control the rotorcraft during an emergency situation." Furthermore, while the regulations require the operator to demonstrate knowledge and skill in external load operations, 14 CFR 133.23(c) does not require a demonstration of pilot ability to actually use the quick-release switch in any mode of operation. In fact, if the operator can show previous experience with external load operations and has a good safety record, the

Administrator can waive the test of skill completely under 14 CFR 133.23(d). The Safety Board believes that, in the absence of definitive design standardization, additional pilot training and demonstration of skill are necessary to enhance pilot familiarization and proficiency in order to prevent confusion in high stress situations.

The Safety Board was encouraged to learn recently of the FAA's Office of Systems Engineering Management's plans for a program devoted to "Cockpit Human Factors Problems." The program is very ambitious and the FAA is commended for its efforts. However, the Board was disappointed to learn that the proposed investigations are directed only at the human factors problems in fixed-wing aircraft and not those encountered in helicopters.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Expand its proposed research plans on "Cockpit Human Factors Problems," particularly in the area of Human Capabilities and Limitations and Displays and Controls, to include problems peculiar to helicopter controls and displays. (Class II - Priority Action) (A-78-23)
>
> Amend 14 CFR 133.23(c)(6) to require the pilot to demonstrate his ability to actuate the quick-release switch in normal and simulated emergency operations. (Class II - Priority Action) (A-78-24)
>
> Issue an Advisory Circular advising rotorcraft external load operators that, whenever the cargo quick-release switch location or function on the pilot's primary control (usually the cyclic grip) is modified, the operators again have their pilots demonstrate their ability to actuate the switch in normal and simulated emergency operation without having to assume an unusual finger or thumb position which may induce unwanted control inputs. (Class II - Priority Action) (A-78-25)
>
> Delete 14 CFR 133.23(d) which permits the Administrator to waive pilot test of skill. (Class II - Priority Action) (A-78-26)

KING, Chairman, BAILEY, Vice Chairman, McADAMS, HOGUE, and DRIVER, Members, concurred in the above recommendations.

By: James B. King
Chairman

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

APR - 6

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

This is to acknowledge the Federal Aviation Administration (FAA) letter dated March 18, 1981, further responding to National Transportation Safety Board Safety Recommendation A-78-48 issued July 24, 1978. This recommendation pertained to the hazard of induction icing in aircraft using engines with injection-type carburetors. We recommended that the FAA require manufacturers of aircraft equipped with these carburetors to publish and provide to all owners the necessary information about the hazard and how to cope with it in flight.

We are pleased to note that the manufacturers have taken the following actions:

- Beech Aircraft issued Letter No. 29012-11 applicable to Models 50, B50, C50, and D50;
- Cessna issued Pilots Checklist procedures for Models 310, 310A, and 310B; and
- Rockwell Commander issued a revision to the Owners Flight Manual for the Model 560E airplane.

We thank the FAA for the fulfillment of this recommendation which we now classify in a "Closed-Acceptable Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

March 18, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-78-48 issued July 24, 1978, and supplements our letter of September 11, 1978. This also responds to your letter of October 21, 1980, in which you requested a progress report. This recommendation concerned the hazard of induction icing in aircraft using engines with injection-type carburetors.

A-78-48.

Require manufacturers of aircraft equipped with the subject carburetors to publish and provide to all owners the necessary information about this hazard and how to cope with it in flight.

FAA Comment.

The Federal Aviation Administration's (FAA) regions, with type certification responsibility for airplanes equipped with the Stromberg PS series carburetors, reviewed the manufacturers' operating instructions for induction icing. The following action has been taken by the manufacturers:

- Beech Aircraft issued Letter No. 29012-11 applicable to Models 50, B50, C50, and D50;
- Cessna issued Pilots Checklist procedures for Models 310, 310A, and 310B; and
- Rockwell Commander issued a revision to the Owners Flight Manual for the Model 560E airplane.

Copies of these documents are enclosed for your information. We believe these actions correct the deficiencies that were of concern to the NTSB in Safety Recommendation A-78-48. Accordingly, the FAA considers action completed on this recommendation.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

October 21, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to National Transportation Safety Board Safety Recommendation A-78-48 issued July 24, 1978. This recommendation concerned the hazard of induction icing in aircraft using engines with injection-type carburetors. We recommended that the Federal Aviation Administration (FAA) require manufacturers of aircraft equipped with these carburetors to publish and provide to all owners the necessary information about the hazard and how to cope with it in flight.

By letter dated September 11, 1978, we were informed that the FAA was requesting its regions with type certification responsibility for airplanes equipped with the Stromberg PS Series carburetor to review the manufacturers' operating instructions for induction icing and to take necessary corrective action. The FAA expected to complete this project by late February 1979.

In our response of October 25, 1978, we stated that Safety Recommendation A-78-48 was being maintained in an "Open--Acceptable Action" status pending the FAA's review of the manufacturers' operating instructions. In order to evaluate the present status of this recommendation and update the public docket, we request a further progress report.

Sincerely yours,

James B. King

James B. King
Chairman

SEP 11 1978

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-78-47 and 48.

A-78-47. Direct accident prevention specialists, flight instructors, and flight examiners, as part of their training or biennial review programs, to inform all owners and pilots of aircraft which use injection-type, pressure carburetors of the aircrafts' susceptibility to impact ice in the induction system.

Comment. In keeping with the established policy in our Accident Prevention Program and flight instructor courses, we will continue to stress to pilots the need to know the contents of aircraft owners manuals and pilot operating handbooks. In addition, we have forwarded copies of this recommendation to our accident prevention coordinators and requested that the information be used in meetings with pilots.

A-78-48. Require manufacturers of aircraft equipped with the subject carburetors to publish and provide to all owners the necessary information about this hazard and how to cope with it in flight.

Comment. This information is required by FAR 23.1581(c) and 23.1585(a). The General Aviation Manufacturers Association (GAMA) Specification for Pilots Operating Handbook, Section 7, Paragraph 7.25(g) also contains a requirement for the information concerning air induction system ice protection. Future pilot handbooks will be prepared by the airplane manufacturers in compliance with the specifications in this handbook. A copy of the pertinent part of the GAMA Handbook is enclosed.

We are requesting our regions with type certification responsibility for airplanes equipped with the Stromberg PS Series carburetors to review the manufacturers' operating instructions for induction icing and take any necessary corrective action. We expect to complete this project by the end of February 1979.

Sincerely,

(Signed) Quentin S. Taylor
Deputy Administrator

Enclosure

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 24, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-78-47 and -48

On November 17, 1977, N3837C, an Aero Commander 560E, crashed on a farm after the pilot initiated an emergency descent near Queen, Pennsylvania. The pilot, who was injured seriously in the crash, died shortly after he was released from a hospital.

The pilot reported that while flying at 9,500 feet between cloud layers he noticed a drop in manifold pressure and experienced engine roughness accompanied by a loss of power in both engines. Although he applied alternate air to both engines, he was not able to regain normal engine operation.

Investigation revealed that both engines were capable of developing full power and that there was sufficient uncontaminated fuel in the fuel tanks to power the engines.

On November 26, 1975, in a similar accident, N699E, an Aero Commander 560E, crashed about a mile from the Quad City Airport, Moline, Illinois. The pilot was killed in the crash.

The National Transportation Safety Board's investigation of the accident disclosed that the pilot had been flying at 11,000 feet on an instrument flight rules (IFR) flight plan when he reported to air traffic control that he could no longer obtain sufficient power from his engines to maintain his assigned altitude. The airplane was being vectored to the Quad City Airport when it crashed in a residential area. Persons who arrived first at the crash site noted that the ram air tubes and mixing chambers of both carburetors were packed with ice.

2398

The Aero Commander 560E uses Stromberg PS Series, Model 5BD carburetors. This is an injection-type, single-barrel, low-pressure carburetor. Fuel is introduced downstream from the throttle valve and beyond the venturi chamber. This design feature virtually eliminates fuel vapor ice and reduces the hazard of throttle ice in the induction system.

A third type of induction ice--impact ice--does pose a problem for aircraft which use injection-type pressure carburetors. When these aircraft are flown for extended periods in weather conditions conducive to the formation of ice on leading edges of the aircraft structure, impact ice may form in the carburetor air inlet ducts, the carburetor screen, the carburetor elbow, the heat valve, and the carburetor metering elements.

Because of the generally favorable design and performance characteristics of the injection-type pressure carburetor, pilots of airplanes such as the Aero Commander 560E may not recognize that impact ice poses a potential hazard for their aircraft. Moreover, undue delay in switching to the alternate air system in some icing conditions may result in an ice accumulation which immobilizes the heat valves. Once this has happened, the pilot may be powerless to counter further ice buildup, and he may subsequently lose all power.

The flight operations manual for the Aero Commander 560E gives the pilot no guidance as to when the alternate air system should be used. The pilot must rely on other sources to obtain this information. One such source is Advisory Circular 60-9, Induction Icing - Pilot Precaution and Procedures, dated February 28, 1973. The AOPA Air Safety Foundation Flight Instructors Safety Report is another informative publication. We believe, however, that additional measures should be undertaken to disseminate this information more widely among the users.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Direct accident prevention specialists, flight instructors, and flight examiners, as part of their training or biennial review programs, to inform all owners and pilots of aircraft which use injection-type, pressure carburetors of the aircrafts' susceptibility to impact ice in the induction system. (Class II -- Priority Action) (A-78-47)

Require manufacturers of aircraft equipped with the subject carburetors to publish and provide to all owners the necessary information about this hazard and how to cope with it in flight. (Class II -- Priority Action) (A-78-48)

KING, Chairman, McADAMS, HOGUE, and DRIVER, Members, concurred in the above recommendations.

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 14, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-78-59 through A-78-62 issued August 18, 1978, and supplements our letter of November 3, 1978. This also responds to your letter of July 22, 1980, in which you requested an updated status report.

A-78-59. Review the procedures employed in the Airport Data Program to insure that instructions to airport managers/owners for annual solicitation of data are clearly and concisely stated, and that data from the Airport Master Record are compared in detail to that published in the NOS Airport/Facility Directory.

A-78-60. Examine the NFDC data base to determine what airport data are not published in the directory, test those data against the publication criteria, and publish as appropriate. Identify nonpublished data so that they are easily recognized as such by airport managers/owners when conducting annual reviews.

A-78-62. Establish the complete program of airport data verification.

FAA Comment. The complete series of Airport Master Record FAA-5010 forms have now been revised. These forms are used for recording the results of a physical airport inspection and for obtaining the status of airports through mail solicitation from airport owners. Concurrently, the instructions for completing and validating the airport inspection data have also been completely revised. FAA Order 5010.4, Airport Safety Data Program, was published on January 27, 1981. A copy of this document is enclosed, and the Federal Aviation Administration (FAA) considers action completed on Safety Recommendations A-78-59, 60, and 62.

A-78-61. In coordination with the NOS and other appropriate agencies, establish symbology for use on the Sectional Aeronautical Chart that will indicate general limitations of airport lighting, with cross-referencing to the appropriate sources for details of the limitation.

FAA Comment. In our letter of November 3, 1978, the FAA informed the Board that we did not believe it was desirable to add symbols or to further complicate the existing symbology on sectional charts because such action may result in confusion and further increase the existing chart clutter. As an alternate action, we proposed to add a note to the legend of all sectional charts explaining that usable airport runway length may be less than the physical length shown on the chart. The note is to include a recommendation for pilots to consult the Airport/Facility Directory, NOTAM's, and/or call the nearest flight service station or airport manager for more detailed and up-to-date information. By letter of February 7, 1979, the NTSB stated that this action was satisfactory and, accordingly, Safety Recommendation A-78-61 was being held in an "Open--Acceptable Alternate Action" status pending completion of this project.

This subject is scheduled for discussion by the Air Agency Cartography Committee during April 1981. We have every reason to believe that this project will be acted upon favorably and, accordingly, we are confident that action will be completed by December 31, 1981. We will inform the Board when the notation to the legend is published on new sectional charts.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

National Transportation
Safety Board

Washington, D.C. 20594

Office of
Chairman

July 22, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to National Transportation Safety Board Safety Recommendations A-78-59 through A-78-62 issued August 18, 1978. These recommendations concerned low-intensity runway lights at Paul Windle Airport, Greensburg, Kansas.

Your response of November 3, 1978, indicated that actions were being taken to fulfill these recommendations. In order to evaluate the progress of these recommendations and update the public docket, we would appreciate an updated status report.

Sincerely yours,

James B. King

James B. King
Chairman

National Transportation Safety Board

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

We have reviewed your letter of November 3, 1978, in response to our safety recommendations A-78-59 through 62, concerning low-intensity runway lights at Paul Windle Airport, Greensburg, Kansas. The Safety Board is appreciative of your positive actions to implement the intent of the recommendations.

Your coordinated efforts with industry to review procedures for data collection forms, airport data verification programs, and airport data publications will fulfill the intent of safety recommendations A-78-59, 60 and 62. These recommendations will be held in an open - acceptable action status pending completion of your projects.

Concerning recommendation A-78-61, your projected addition of a note to the legend of all sectional charts explaining that the usable airport runway length may be less than the physical length shown on the chart is satisfactory action. Therefore, this recommendation will be held in an open - acceptable alternate action status pending completion of your project.

Sincerely yours,

James B. King
Chairman

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SUMMARY OF FEDERAL AVIATION ADMINISTRATION RESPONSES TO NATIONA--ETC(U)
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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

November 3, 1978

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-78-59 through 62.

A-78-59. Review the procedures employed in the Airport Data Program to insure that instructions to airport managers/owners for annual solicitation of data are clearly and concisely stated and that data from the Airport Master Record are compared in detail to that published in the National Ocean Survey (NOS) Airport/Facility Directory.

A-78-62. Establish the complete program of airport data verification.

Comment. In response to A-78-59 and 62, data collection forms and procedures employed in the Airport Data Program are being revised utilizing the expertise of a regional Airports Programs working group. This group has coordinated its initial draft efforts throughout the agency and industry. Comments are being finalized for recoordination after which implementation is expected during 1979. When issued, the instruction will be concise and clearly stated to provide a significant improvement in the accurate and timely collection, verification, and dissemination of data on the Nation's public and private-use airports. Our objective, through the increased effort now provided, is the eventual achievement of a program capable of providing complete airport data verification.

A-78-60. Examine the National Flight Data Center (NFDC) data base to determine what airport data are not published in the directory, test those data against the publication criteria, and publish as appropriate. Identify nonpublished data so that they are easily recognized as such by airport managers/owners when conducting annual reviews.

Comment. An effort is being made by the NOS to insure that all pertinent data contained in the NFDC data base are included in the Airport/Facility Directory.

NFDC is making a recommendation to the Office of Airport Programs to identify on the Airport Master Report, data that will be published either in the Airport/Facility Directory or on aeronautical charts. The implementation of this recommendation will be no later than December 31, 1979.

A-78-61. In coordination with the NOS and other appropriate agencies, establish symbology for use on the Sectional Aeronautical Chart that will indicate general limitations of airport lighting, with cross-referencing to the appropriate sources for details of the limitation.

Comment. It is not desirable to add any symbols or further complicate the existing symbology on Sectional Charts because it may result in confusion and an increase in the already critical chart clutter. Very little detailed information could be included, even if new symbols were employed. However, a note will be added to the Legend of all Sectional Charts explaining that usable airport runway length may be less than the physical length shown on the chart; availability of runway lights does not necessarily mean the lighted runway is the longest runway, or that it is lighted full length. The note will include a recommendation for pilots to consult the Airport/Facility Directory and Notices to Airmen, and/or to call the nearest flight service station or airport manager for more detailed and up-to-date information, as many unexpected conditions may exist that cannot be included on this chart.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: August 18, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-78-59 through -62

On the night of July 27, 1976, N56712, a Piper PA 34-200, landed on runway 17 at Paul Windle Airport, Greensburg, Kansas, continued past the end of the runway, struck the bank of a ditch, and came to rest in an open wheat field. Two passengers were killed, and the pilot and another passenger were seriously injured.

Investigation revealed that low-intensity runway lights were installed only on the south 2,176 feet of runway 17/35, which is 2,580 feet long. At that time, however, the current issue of the Airman's Information Manual (AIM) Airport Directory contained only the following pertinent information for the airport: Runway 02/20 is the longest of two runways and is 2,800 feet long; low-intensity runway lighting; airport attended dawn to dusk and other times on call; powerlines on approach to runways 20 and 17.

A remark reflecting the correct runway lighting condition had been in the FAA Airport Master Record as early as 1965, but was not published in the AIM until after the accident in the Fall/Winter 1976/77 issue. Publication of the remark was a result of its being "flagged" on May 3, 1976, by the National Flight Data Center (NFDC). However, it did not appear in the daily National Flight Data Digest or in the AIM, Volume 3a, Special Notices, although the information did qualify for publication. We were not able to determine that new system procedures or checks had been put into effect to prevent similar oversights.

Further study disclosed that the Sectional Aeronautical Chart published by the National Ocean Survey (NOS) does not inform the pilot that the Greensburg airport runway lights are other than normal in any respect. The legend for these charts includes three symbols which indicate specific limitations of the airport lighting, and the pilot must research further to determine the details of the limitation. However,

none of these symbols could have been used to connote the particular lighting limitation at Greensburg, and no other symbology was provided to indicate a general limitation of the lighting. The Safety Board believes that a pilot would be alerted to any abnormality by substituting the current definition of the symbol (L) with a statement, such as "Lighting limited in hours of operation or capability -- for current status and details refer to the Airport/Facility Directory and NOTAM's or contact the airport manager or tie-in/associated FSS."

In March 1978, the NOS assumed responsibility for the publication of an airport/facility directory. The new publication derives information from the FAA NFDC automated data base, the same data base in use to publish the Airport Directory of the AIM. The Safety Board believes that the FAA should assure publication of all appropriate information contained in the data base.

The Greensburg airport does not require certification by the FAA according to 14 CFR 139. The airport manager/owner is responsible for accuracy of the data available to the FAA. However, at least two FAA surveys of this airport were certified by FAA inspectors between 1965 and 1976 while this lighting condition existed. These surveys recorded the proper condition, but did not result in publication of correct information in the AIM. Further, we understand that FAA Flight Service Stations annually receive Airport Master Record data on airports within their areas of jurisdiction, but their participation did not result in distribution of accurate information on this airport.

The FAA Airport Data Program solicits information annually from airport managers/owners to update the NFDC data base. In this case, the airport manager had responded to the annual solicitations, but that did not cause accurate publication. Possibly, the program does not provide sufficient guidelines to promote thorough review and proper submission of their airport data. There was no indication that anyone had compared the Airport Master Record data to that published in the AIM. The FAA Office of Airport Programs has reportedly, for some time, attempted to improve the methods used to obtain information on noncertificated public airports. We understand that current funding only provides for survey and verification of data on 30 percent of the airports involved, and that funds for a comprehensive program are included in the FAA's budget proposal for 1980.

The Safety Board believes that the inaccuracy of the published information on the Greensburg airport, coupled with failure of the system to detect that the information contained in the AIM and in the NFDC data base was not consistent, may be symptomatic of a system problem and not an isolated occurrence. Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Review the procedures employed in the Airport Data Program to insure that instructions to airport managers/owners for annual solicitation of data are clearly and concisely stated, and that data from the Airport Master Record are compared in detail to that published in the NOS Airport/Facility Directory. (Class II-Priority Action) (A-78-59)

Examine the NFDC data base to determine what airport data are not published in the directory, test those data against the publication criteria, and publish as appropriate. Identify nonpublished data so that they are easily recognized as such by airport managers/owners when conducting annual reviews. (Class II-Priority Action) (A-78-60)

In coordination with the NOS and other appropriate agencies, establish symbology for use on the Sectional Aeronautical Chart that will indicate general limitations of airport lighting, with cross-referencing to the appropriate sources for details of the limitation. (Class II-Priority Action) (A-78-61)

Establish the complete program of airport data verification. (Class II-Priority Action) (A-78-62)

KING, Chairman, McADAMS, HOGUE, and DRIVER, Members, concurred in the above recommendations.

James B. King

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 11, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-78-67 through A-78-74 issued September 6, 1978, and supplements our letter of November 28, 1978. This also responds to your letter of February 27, 1981, in which it was restated that these recommendations were being held in an "Open--Acceptable Action" status pending completion of upgrading of Technical Standards Order (TSO) C-62b. An updated status report was also requested in that letter.

A-78-67. Assess current tire rating criteria, as used by the Tire & Rim Association and as interpreted by airframe designers and Federal standards, in terms of compatibility of tire, airframe, and intended operation to assure that adequate margins are provided for all normal conditions.

FAA Comment. Aircraft tires are selected for a specific aircraft based on a load rating and corresponding inflation pressure as established by the Tire and Rim Association standards. The tire is qualified to the current TSO for that load rating and inflation pressure. In order to have the tire approved for a particular aircraft, it must be certificated to meet the appropriate Federal Aviation Regulations (FAR) regarding compatibility of the tire with the aircraft performance and operation. The tire is tested on the aircraft before the configuration is approved.

The Federal Aviation Administration (FAA) has assessed this process of approving aircraft tires and has found these procedures to be satisfactory. They assure that adequate margins are provided. Therefore, we believe that compliance with the recommendation has already been accomplished, and the FAA plans no further action.

A-78-68. Upgrade Technical Standard Order C-62b to reflect current engineering practices and operational conditions in both the specifications for performance standards and certification test requirements.

FAA Comment. The FAA revised the TSO for tires on November 29, 1979, to include more severe testing requirements and higher tire load margins. These include testing tires to a 50 percent overload. In addition, FAR 25.733 was revised on November 29, 1979, to include a 1.07 factor in establishing the required load rating of the tire on the airplane. We are enclosing copies of these documents, and the FAA plans no further action on this recommendation.

A-78-69. Insure that the tire is compatible with the airframe by considering this compatibility during the airplane certification. Tire loads which result from design peculiarities and normal variations in maintenance and operational practices must be considered.

FAA Comment. The airplane certification procedures have always accounted for compatibility of the tire with the airframe. This is accomplished by analysis, static tests, and functional testing of the landing gear system during the type certification program. The design loads for the tire which account for variations in design, maintenance, and operational practices are established in accordance with regulatory requirements. Improvements in this area have been accomplished as discussed in our response to Recommendation A-78-68. Therefore, the FAA plans no further action on this recommendation.

A-78-70. Issue a new Technical Standard Order to specify performance standards and qualification test requirements for retreaded tires.

FAA Comment. The revised TSO-C62c for aircraft tires requires that the manufacturer furnish applicable maintenance data which includes inspection criteria for recapped tires to continue in service. Recapping procedures must be included along with any special repair procedures and special nondestructive inspection techniques applicable to that tire. In addition, we have published a proposed Advisory Circular (AC) for public comment on qualification of retread tires (copy enclosed). The AC will provide guidance for the development, qualification, and approval of aircraft tire repair and retread process specification, and the use of special nondestructive inspection techniques. It will also provide information related to recent rule changes on aircraft tires used on transport category airplanes in order that tire reliability will be enhanced and the incidence of tire failures decreased. In view of the above, and the continued emphasis placed by the FAA and the aviation industry on tire maintenance, no further steps are considered necessary to meet the intent of this recommendation, and the FAA considers action completed.

A-78-71. Prohibit different model tires or tires manufactured by different manufacturers from being mounted on the same axle where different characteristics between such tires can affect tire loading under normal operating conditions.

FAA Comment. The variation of tire loads on airplanes with dual or tandem landing gear has been considered in the revision of FAR 25.733 and the new tire TSO. The 7 percent higher load margin and more severe tire qualification testing were included to account for tire load variations resulting from different model tires or tires from different manufacturers. We believe this meets the intent of the Board's recommendation. The FAA plans no further action on Recommendation A-78-71.

A-78-72. Require that operator maintenance and operational practices regarding tire usage, such as taxi speeds and distances and inflation pressures, are in accordance with the tire manufacturers' recommendations.

FAA Comment. We consider that the operator maintenance and operational practices, as contained in the FAA-approved operators' manuals, are satisfactory. In most cases they closely parallel the manufacturers' recommendations and, in some cases, exceed them. Operators in most cases have developed programs which best suit their own requirements, environmental conditions, stage length, etc. Advisory Circular 20-97, High-Speed Tire Maintenance and Operational Practices, which provides information on the causes of aircraft tire failures and methods of increasing tire reliability, and Maintenance Bulletin No. 32-3, Aviation Tire Maintenance Practices, were issued in 1977. Copies are enclosed. In April 1978, we conducted a special 30-day tire surveillance program. Our inspectors were directed to increase their surveillance activity to check for conformity with the aforementioned AC and maintenance bulletin. This effort resulted in approximately 1,500 special inspections resulting in only 46 cases where corrective action was required. A copy of the final report is enclosed. The FAA plans to take no further action on this recommendation.

A-78-73. Expedite the development of a nondestructive inspection technique which would detect flaws in tire carcasses. Require nondestructive inspection for new and retreaded tires and develop criteria based upon such inspection to withdraw a faulty tire from service.

FAA Comment. Approval and funding were provided in March 1980 for a research and development (R&D) project regarding recapped aircraft tires. This research is being conducted by the Transportation Systems Center in Cambridge, Massachusetts. The objective of this project is to set forth retread standards for in-service tire qualification, tests, and inspections. The effort will investigate life and retread

limits for these tires, and also establish standards for nondestructive inspection which will include the latest state-of-the-art technology. We estimate completion of this project in December 1981, at which point we will review the results to determine the most appropriate follow-on action.

A-78-74. In the interim, establish a safe upper limit for the number of retread cycles allowed each model tire.

FAA Comment. There is no data which would support a limit for the number of retread cycles allowed. Surveys conducted over the years indicate that new and recapped tires have almost identical reliability experience. The reliability of any tire, new or recapped, is dependent primarily on maintenance, operational practices, and inspections prior to recapping.

As a result of the R&D program discussed in Recommendation A-78-73, the FAA may be able to provide information to the aviation community concerning the life limits of tires.

Sincerely,

J. Lynn Helms
Administrator

Enclosures

Office of the Chairman

FEB 27 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Please refer to the National Transportation Safety Board's Safety Recommendations A-78-67 through 74 pertaining to tire rating criteria, performance standards, test requirments for retreaded tires, and tire usage and mounting. By letter dated February 1, 1979, we advised the Federal Aviation Administration (FAA) that these recommendations were being held in an "Open--Acceptable Action" status pending completion of the FAA's regulatory proposal, upgrading of Technical Standard Order C-62b, and the FAA's assessment of tire rating criteria. In order to evaluate the progress of these recommendations and update the public docket, we would appreciate an updated status report.

Sincerely yours,

James B. King
Chairman

17 APR 1979

Federal Aviation Administration
Office of the Chief Counsel
300 Independence Avenue, S.W.
Washington, D.C. 20591

Re: Rules Docket (ACC-24)
Docket No. 18887

Gentlemen:

The National Transportation Safety Board has reviewed Notice of Proposed Rulemaking, Docket No. 18887, Notice No. 79-7, which was published in the Federal Register (44 FR 16430) on March 19, 1979. The Board concurs in your proposal to revise the Technical Standard Order for Aircraft Tires (TSO-C62b) and the related transport category airplane type certification requirement.

While the revised testing requirements do reflect more realistically the severe operating conditions encountered by high performance tires, the Safety Board is concerned that the test temperatures specified may not be sufficiently conservative. The tire failures on the Continental Airlines DC-10 at Los Angeles were caused by overheat. Tire operating temperatures during taxi and takeoff are determined by a number of factors such as distance, speed, inflation pressure and load as related to tire deflection, and the ambient temperature. The revised TSO requirements specify only the initial temperature for testing. Therefore, the carcass temperature obtained during a test may not simulate actual operating conditions. We believe that the test conditions should be so specified to ensure that the carcass temperature profile during a test will conservatively represent the most severe conditions encountered in service.

Sincerely yours,

(ORIGINAL SIGNED BY/ JAMES B KING

James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

February 1, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

We have reviewed your letter of November 28, 1978, in response to safety recommendations A-78-67 through 74, concerning tire rating criteria, performance standards, test requirements for retreaded tires, and tire usage and mountings. The Safety Board is pleased with the positive actions taken by the Federal Aviation Administration to fulfill the intent of the recommendations. Therefore, these recommendations will be held in an open - acceptable action status pending completion of your projected regulatory proposal, upgrading of Technical Standard Order (TSO) C-62b, and your assessment of tire rating criteria.

Sincerely,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

November 28, 1978

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-78-67 through 74.

A-78-67. Assess current tire rating criteria, as used by the Tire and Rim Association and as interpreted by airframe designers and Federal standards, in terms of compatibility of tire, airframe, and intended operation to assure that adequate margins are provided for all normal conditions.

Comment. The FAA has assessed the entire process by which tires are approved, including use of the Tire & Rim Association Handbook. Aircraft tires are approved on the basis of conformance to prescribed certification and performance requirements contained in appropriate Federal Aviation Regulations (FAR) and the associated Technical Standard Order (TSO). The selected tire ratings, as substantiated by compliance with these requirements, result in compatibility of the tire with the airframe and its intended operation. Tests of the tire installed on the airplane are completed before the configuration is approved.

A-78-68. Upgrade Technical Standard Order (TSO) C-62b to reflect current engineering practices and operational conditions in both the specifications for performance standards and certification test requirements.

Comment. We have initiated a regulatory project to propose revisions to FAR Sections 25.733 and 37.167 Aircraft tires-TSO-C62b, tire certification and performance standards. These proposals will include higher tire load margins and more severe testing provisions. We expect to issue the proposals in February 1979.

A-78-69. Insure that the tire is compatible with the airframe by considering this compatibility during the airplane certification. Tire loads which result from design peculiarities and normal variations in maintenance and operational practices must be considered.

Comment. Current procedures consider compatibility during airplane certification. Tire load ratings take into account variations in design, maintenance and operational practices and are substantiated in accordance with regulatory requirements. Improvements in this area are contained in the proposals and discussed in the response to Recommendation A-78-68 above.

A-78-70. Issue a new Technical Standard Order to specify performance standards and qualification test requirements for retreaded tires.

Comment. The proposed revision to TSO-C62b will include a provision that manufacturers furnish maintenance and repair information to the FAA-TSO approving office upon request by that office. In addition, an advisory circular dealing with tire recapping will be developed.

A-78-71. Prohibit different model tires or tires manufactured by different manufacturers from being mounted on the same axle where different characteristics between such tires can affect tire loading under normal operating conditions.

Comment. The variation in tire loads, as experienced on airplanes with dual or tandem landing gear trucks, has been considered in current proposals. Higher load margins and more severe testing provisions are being proposed to account for tire load variations, such as those resulting from different model tires or tires from different manufacturers.

A-78-72. Require that operator maintenance and operational practices regarding tire usage, such as taxi speeds and distances and inflation pressures, are in accordance with tire manufacturers' recommendations.

Comment. We consider that the operator maintenance and operational practices, as contained in the FAA-approved operators manuals, are satisfactory. In most cases they closely parallel the manufacturers' recommendations and, in some cases, exceed them. Operators in most cases have developed programs which best suit their own requirements; i.e., frequent maximum versus less than maximum load conditions, environmental conditions, stage lengths, etc. Advisory Circular 20-97, "High-Speed Tire Maintenance and Operational Practices," and Maintenance Bulletin No. 32-3, "Aviation Tire Maintenance Practices," were issued in 1977. In April 1978, we conducted a special 30-day tire surveillance program. Our inspectors were directed to increase their surveillance activity to check for conformity with the aforementioned advisory circular and maintenance bulletin. This effort resulted in approximately 1500 special inspections resulting in 46 cases where corrective action was required.

A-78-73. Expedite the development of a nondestructive inspection technique which would detect flaws in tire carcasses. Require nondestructive inspection for new and retreaded tires and develop criteria based upon such inspection to withdraw a faulty tire from service.

Comment. A research and development program (R&D) has been initiated to evaluate the capability of several nondestructive inspection methods which would be used for identifying flaws and failure areas in tires. We expect to complete this project in December 1978.

A-78-74. In the interim, establish a safe upper limit for the number of retread cycles allowed for each model tire.

Comment. We do not have data which would support a limit for the number of retread cycles allowed. Surveys conducted over the years indicate that new and recapped tires have almost identical reliability experience. The reliability of any tire, new or recapped, is dependent primarily on maintenance and operational practices.

The installation of new treads is predicated on the condition of the tire carcasses and recapping procedures. The information contained in the proposed TSO revision and the findings from the R&D project noted in Recommendations A-78-68 and 73 will provide the basis for an advisory circular dealing with tire recapping.

We will establish an advisory circular project coincident with completion of the TSO and R&D projects.

We believe that these actions meet the intent of the recommendations.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

MAY 23

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S. W.
Washington, D.C. 20594

Dear Mr. Chairman:

Your letter of April 23 presents several issues that we agree must be fully considered. We are already proceeding along those lines with all possible urgency. Specific actions underway or planned for the near future include:

1. Research has been initiated to improve tire performance and reduce failure rates by developing means to improve tire overload capability and to develop improved tire pressure indication systems and advanced nondestructive inspection techniques.

2. Advisory material was issued to the airlines (Advisory Circular 20-97, 1/23/77) on procedures to follow in tire operation and maintenance. A parallel alert to FAA inspectors was included in FAA Maintenance Bulletin dated January 23, 1977.

3. For anti-skid systems, an advisory circular (AC 25-59, "Anti-Skid and Associated Systems") was issued on May 27, 1977, to assure that tire failure is considered in designing and approving anti-skid systems.

4. A telegraphic notice applied to wide-bodied and four-engine-turbojet aircraft was issued on April 14, 1978, to require close monitoring of tire operation and maintenance by our inspectors.

5. A specialist team has been formed to review compliance of the DC-10 with the related rules, determine if there were any deficiencies and what corrective actions should be taken, and also to provide any recommendations on needed rule changes.

We do not have sufficient information at the present time to associate your four issues with specific requirements. That is part of the specialist team's assignment, and copies of your letter have been given

to the team for its full consideration. While we are presently concentrating on the DC-10, we feel some of the problems being investigated may be present in other transport aircraft types.

We will keep you apprised of the progress of our specialist team and will forward a copy of its report and its recommendations as soon as this work is completed.

Sincerely,

(Signed) Langhorne Bond
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

April 25, 1978

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

The National Transportation Safety Board is currently continuing its investigation of the accident, involving multiple tire failures on a Continental Air Lines DC-10, which occurred at Los Angeles International Airport, on March 1, 1978. In addition, we are conducting separate investigations into several other take-off incidents involving similar tire failures.

While the above investigations are not yet completed, and a public hearing in this matter will be convened on May 30, 1978, sufficient evidence relative to the overall issue of tire reliability on DC-10 aircraft has at this time been brought to light for this subject to become a matter of grave concern to the Safety Board. As the investigation progresses, we expect to be forwarding specific recommendations to you.

In the meantime, we are aware of the Federal Aviation Administration's establishment of a special team to review DC-10 tires, wheels and brake problems and the Safety Board believes that several issues related to tire reliability are well defined now and need to be addressed immediately.

(1) The narrow margin of rated load over maximum tire load on the 32-ply tires used on DC-10 aircraft. At the present time the load margin is such that even a slight deterioration of load bearing capability of one tire on one axle will result in a gross overload and probable failure of the mating tire at given speeds and temperatures.

(2) Definition of limits on taxi distance and taxi speeds vs. aircraft weight, center of gravity and surface temperatures.

(3) Inspection requirements and performance standards for retreaded tires.

(4) Airline schedules very often dictate a quick turn-around of an airplane thus making it extremely difficult to obtain precise tire pressures, particularly when accurate tire temperatures cannot be ascertained and turn-around time does not permit tire cooling to ambient temperatures.

Notwithstanding the findings of your special team and the Safety Board's investigation, we believe that technology and hardware are now available to effect an immediate improvement of the overall tire situation and possibly prevent the occurrence of an even more catastrophic accident in the future.

Accordingly, we would appreciate it if you could advise us at the earliest possible date what specific actions are presently underway and what action the Federal Aviation Administration contemplates in the near future relative to reliability of DC-10 tires.

Sincerely yours,

James B. King

James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: September 6, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-78-67 through -74

In a letter to the Federal Aviation Administration dated April 25, 1978, the National Transportation Safety Board expressed its concern about multiple tire failures on wide-bodied aircraft, such as that experienced by the Continental Air Lines DC-10 at Los Angeles International Airport on March 1, 1978. Your response, dated May 23, 1978, detailed several actions which the FAA had underway or was planning to initiate. The Safety Board acknowledges these actions as a step toward reducing the potential risk of tire failures. However, the Safety Board's public hearing, which was convened on May 30, 1978, as part of the investigation of the DC-10 accident, elicited much testimony regarding factors which can affect tire safety and reliability; and as a result, we believe that additional regulatory or advisory actions are needed in the areas of design standards, qualification testing, quality control during manufacture, and operational limits. Our concerns apply to retreaded tires as well as new tires.

From the hearing testimony, it became evident that some confusion exists within the industry regarding the significance of a tire's rated load, as defined by the Tire & Rim Association, and the consideration given when mating a particular tire with airframe design and intended operations. For example, under current practices, a tire may be used on an airplane if the maximum calculated static load does not exceed the tires' rated load; maximum calculated static load is based on equal load distribution between those tires which are mounted on the same axle. No margin is required for possible overload from unequal load distribution which can be created by normal differences between the two tires. These are differences in deflection characteristics between tires from different manufacturers, differences in retread levels, differences in inflation pressures, differences in outside diameters, and differences in wear. In addition, no margin is provided for possible overload caused by the angle at which the landing gear contacts the airport surface. We believe that steps must be taken to insure that such factors are considered when tires are selected and when maintenance and operational practices are established for the aircraft's service life.

2335A

The minimum performance standards for aircraft tires, as established by TSO-C62b, have not been revised since 1962. The existing standards do not reflect the current state of the art in either tire development and testing, or in aircraft design as it affects tire usage and operational service life. For example, the tire's ability to withstand overloads created by the use of different tires on an airplane or by normal variations in inflation pressure is not considered. Also certification test requirements are not correlated with the tire's actual service, including its potential retread life, to relate the design's resistance to carcass fatigue to an established life limit. Furthermore, the TSO requires that only one tire of a given design be tested, and this may be either a preproduction or an early production tire which may not be representative of tires produced at other times during the production period. The Safety Board believes that a larger sample should be tested to assure conformance with design and quality standards.

Since TSO-C62b applies only to new tires, there is even less control over the design and quality of retreaded tires than over new tires. Standards are needed to assure that changes such as tread design, rubber composition, breaker ply, or skid depth do not adversely affect the tire's performance or projected service life. Testimony at the hearing disclosed that some retread manufacturers do qualify new retread designs by limited testing on a voluntary basis.

In addition, currently there are no methods of nondestructive inspection (NDI) available to insure satisfactorily that carcasses intended for retread are free of defects which can produce premature failure. Although it has limitations, the holographic process has been used to detect flaws or damages in the tread area of the carcass before retreading the tire or returning it to service. Some users already specify NDI for all tires either before or after retreading. Although rejection rates are between 3 and 4 percent for the typical aircraft tire, one special design tire has a 30-percent rejection rate. NDI by holography costs about $15.00 per tire. Other methods of NDI, such as ultrasonic and X-ray, have also proven effective for detecting certain flaws in different parts of a tire. None of these, however, have proven effective in detecting common flaws, such as bead damage or fatigue in the ply structure of the sidewalls. Until effective NDI techniques are developed, the Safety Board believes that a conservative, safe upper limit should be set for the number of retread cycles allowed for each model tire.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Assess current tire rating criteria, as used by the Tire & Rim Association and as interpreted by airframe designers and Federal standards, in terms of compatibility of tire, airframe,

and intended operation to assure that adequate margins are provided for all normal conditions. (Class II Priority Action) (A-78-67)

Upgrade Technical Standard Order C-62b to reflect current engineering practices and operational conditions in both the specifications for performance standards and certification test requirements. (Class II Priority Action) (A-78-68)

Insure that the tire is compatible with the airframe by considering this compatibility during the airplane certification. Tire loads which result from design peculiarities and normal variations in maintenance and operational practices must be considered. (Class II Priority Action) (A-78-69)

Issue a new Technical Standard Order to specify performance standards and qualification test requirements for retreaded tires. (Class II Priority Action) (A-78-70)

Prohibit different model tires or tires manufactured by different manufacturers from being mounted on the same axle where different characteristics between such tires can affect tire loading under normal operating conditions. (Class I Urgent Action) (A-78-71)

Require that operator maintenance and operational practices regarding tire usage, such as taxi speeds and distances and inflation pressures, are in accordance with the tire manufacturers' recommendations. (Class II Priority Action) (A-78-72)

Expedite the development of a nondestructive inspection technique which would detect flaws in tire carcasses. Require nondestructive inspection for new and retreaded tires and develop criteria based upon such inspection to withdraw a faulty tire from service. (Class II Priority Action) (A-78-73)

In the interim, establish a safe upper limit for the number of retread cycles allowed each model tire. (Class II Priority Action) (A-78-74)

KING, Chairman, McADAMS, HOGUE, and DRIVER, Members, concurred in the above recommendations.

James B. King

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

We thank the Federal Aviation Administration (FAA) for its letter dated April 15, 1981, received in further response to National Transportation Safety Board Safety Recommendation A-78-76 issued October 17, 1978. This recommendation stemmed from our investigation of accidents and incidents involving fuel system contamination and blockage. We recommended that the FAA:

> Issue an Airworthiness Directive similar to AD 67-26-3 for all Piper PA-28 and PA-32 aircraft to require that the interior surfaces of both main fuel tanks are inspected for evidence of sealant deterioration. This inspection should be repeated at prescribed intervals to insure continued airworthiness of the aircraft until a permanent solution to the problem of fuel-tank sealant deterioration is resolved.

We have reviewed Airworthiness Alert (AC-43-16) of April 1979 and actions taken by Piper to further minimize fuel system contamination. We are satisfied that the measures taken fulfill the intent of Safety Recommendation A-78-76 which we now classify in a "Closed--Acceptable Alternate Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 15, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-78-76 issued on October 17, 1978, and supplements our letter of January 3, 1979. This also responds to your letter of September 17, 1980, in which you requested an updated status report.

A-78-76.

Issue an Airworthiness Directive similar to AD 67-26-3 for all Piper PA-28 and PA-32 aircraft to require that the interior surfaces of both main fuel tanks are inspected for evidence of sealant deterioration. This inspection should be repeated at prescribed intervals to insure continued airworthiness of the aircraft until a permanent solution to the problem of fuel-tank sealant deterioration is resolved.

FAA Comment.

Our letter of January 3, 1979, indicated that Piper PA-28 and PA-32 fuel tanks manufactured during 1965 and 1966 were sealed with a sloshing compound, EC 776SR, which was found susceptible to peeling. Airworthiness Directive (AD) 67-26-3 was therefore issued requiring that the interior of these tanks be inspected for separation or loosely attached sealing material film and resealed with an improved sealant, Randolph Sloshing Sealer 802, if necessary. If no peeling or separation was found, the AD required repetitive inspections until 1000 hours time was accumulated. No further inspections were called for because satisfactory inspections indicated proper application and adhesion of the sealing compound to the tank inner surfaces. If no evidence of separation is detected after 1000 hours, we are confident that the compound has been applied correctly and successful adhesion is insured.

The Randolph Sloshing Sealer 802 has proven satisfactory when applied in accordance with the manufacturer's instructions. The fuel tank sealant problems reported after release of AD 67-26-3 were due to improper

sealant application when complying with the AD or when making field repairs. The FAA issued an Airworthiness Alert (AC-43-16) in April 1979, emphasizing the importance of strict adherence to the instructions provided with the Randolph Sloshing Sealer 802, and other measures for preventing fuel system contamination. A copy of that alert is enclosed.

As stated in our January 3, 1979, letter, the sloshing process using EC 776SR was discontinued after 1966, and a different sealant, PRC 1422 has been applied only to the skin laps of production airplanes. Analysis of service history of tanks manufactured after discontinuance of the sloshing process indicates no basis for airworthiness directive action.

In response to requests made by our Southern Region for changes to Piper Aircraft systems and procedures to further minimize fuel system contamination, Piper has accomplished the following actions:

1. Reviewed the engineering specifications for surface preparation and has added a vacuum cleaning requirement to the specifications.

2. Reviewed the thread sealant requirement and determined its adequacy. In addition, a short training program for all employees engaged in this phase of tank production has been introduced to assure proper application of thread sealant.

3. Relocated the tank fabrication area to insure that the handling, packaging, and storage of fuel system components will be properly conducted. Extra emphasis is being placed on insuring that all components are in satisfactory condition, free from contamination, prior to installation.

4. Reviewed inspection procedures and determined that they are adequate regarding detection of contamination. Additional warnings have been added to the service manual regarding proper resealing procedures.

We believe these actions satisfy the intent of Safety Recommendation A-78-76. Accordingly, FAA considers action completed on this recommendation.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Please refer to your letter dated January 3, 1979, and the National Transportation Safety Board's response of February 6, 1979, regarding Safety Recommendation A-78-76 issued October 17, 1978. This recommendation emanated as a result of some fuel starvation accidents. We proposed the issuance of an Airworthiness Directive for all Piper PA-28 and PA-32 aircraft to require that the interior surfaces of both main fuel tanks be inspected for evidence of sealant deterioration.

The Federal Aviation Administration's response indicated that actions were underway to satisfy the intent of this recommendation. In order to evaluate its present status and update the public docket, we request an updated status report.

Sincerely yours,

James B. King
Chairman

Office of the
Chairman

**National Transportation
Safety Board**

Washington, D.C. 20594

February 6, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to your letter dated January 3, 1979, relating to recommendation A-78-76. This recommendation emanated as a result of some fuel starvation accidents and proposed the issuance of an Airworthiness Directive for all Piper PA-28 and PA-32 aircraft to require that the interior surfaces of both main fuel tanks be inspected for evidence of sealant deterioration.

The National Transportation Safety Board is pleased to note that the Federal Aviation Administration has called upon the manufacturer to take several actions for the detection and removal of fuel system contamination and that a maintenance alert will be issued emphasizing the importance of strict adherence to the procedures provided with the Randolph Sloshing Sealer 802 compound. In view of the FAA's proposed actions, the status of this recommendation is now classified as "Open - Acceptable Alternate Action."

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

January 3, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-78-76.

A-78-76. Issue an Airworthiness Directive similar to AD-67-26-3 for all Piper PA-28 and PA-32 aircraft to require that the interior surfaces of both main fuel tanks are inspected for evidence of sealant deterioration. This inspection should be repeated at prescribed intervals to insure continued airworthiness of the aircraft until a permanent solution to the problem of fuel-tank sealant deterioration is resolved.

Comment. Approximately 74,500 fuel tanks have been manufactured at the Piper Vero Beach Plant. During the years 1965 and 1966, approximately 9,600 tanks were sealed by a sloshing process using sloshing compound EC 776SR. This compound was found to be susceptible to peeling and its use was discontinued after 1966. Airworthiness Directive (AD) 67-26-3 requires that tanks sealed with EC 776SR compound be inspected and resealed as necessary with Randolph Sloshing Sealer 802. This sealant has proven satisfactory when applied in accordance with the manufacturer's instructions. We have reports of 10 sealant service problems on PA-28 and PA-32 airplanes for the most recent 5-year period. The available evidence indicates that these were caused by improper sealant application when complying with AD 67-26-3 or making field repairs.

After 1966 the sloshing process was discontinued. Since that time, PRC 1422 sealant has been used and is applied only to the skin laps of production airplanes. Analysis of available service history on this process does not provide any basis for airworthiness directive action at this time.

We are taking actions, however, to minimize the probability of fuel flow interruption due to contamination by sealant deterioration. We have requested that the manufacturer take the following actions:

> Implement improved cleaning and flushing procedures for the fuel system during manufacturing buildup.

Revise the inspection items required at annual inspection as listed in the aircraft service manual to emphasize the detection of fuel system contamination.

Revise the appropriate service manuals to emphasize cleaning and thorough removal of all old sealant prior to resealing, and to specifically prohibit localized or spot sealing.

In addition, we are preparing to issue a maintenance alert item emphasizing the importance of strict adherence to the fuel tank sloshing procedures provided with the Randolph Sloshing Sealer 802 compound.

We expect to complete these actions within 90 days.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: October 17, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-78-76

On March 30, 1967, the National Transportation Safety Board recommended that the Federal Aviation Administration issue an Airworthiness Directive to require an internal inspection of the main integral fuel tanks on Piper PA-28 and PA-32 series airplanes for evidence of fuel-tank sealant (sloshing compound) deterioration. Those tanks found faulty were to be repaired or replaced before further passenger or commercial flights. The Safety Board further recommended that the inspection be required continually on all PA-28 and PA-32 series airplanes at appropriate intervals until a permanent solution to the peeling and flaking problem could be found.

The Safety Board based its recommendation on the finding of fuel-tank sealant deterioration in two PA-28 and a PA-32 aircraft that were involved in fatal accidents. Also, fifty or more model PA-28/32 aircraft were visually inspected, and more than half the tanks were found to contain deteriorated sealant.

In response to the Safety Board's recommendation, Airworthiness Directive 67-26-3 was issued which called for inspections of the fuel tanks and removal of loose sealant material in certain model PA-28 and PA-32 production aircraft. Since the manufacturer changed the compound used in subsequent models PA-28 and PA-32 production aircraft, only those with the older compound were affected by the AD.

Although the change to a different sloshing compound was apparently considered a solution, continuing difficulties have indicated otherwise. A review of FAA Service Difficulty Reports from 1974 through 1977 disclosed 14 cases involving problems directly associated with fuel-tank sealant deterioration in Piper PA-28 and PA-32 aircraft. Seven of these cases involved loss of engine power either just after takeoff or during the final approach sequence; four resulted in serious accidents.

2492

On June 3, 1974, a Piper PA-28-160, N5404W, serial No. 28-472, was involved in an accident at Belleville, Michigan. The accident occurred just after takeoff when engine power was lost. The aircraft struck a house and crashed. Investigation disclosed that liquefied fuel-tank sealant had partially restricted the fuel screen to the engine carburetor.

On June 21, 1974, a Piper PA-28-235, N8744W, serial No. 28-10284, was involved in an accident at Troy, Michigan, just after takeoff; this engine also lost power. The aircraft struck a powerline and crashed. Investigation disclosed that the fuel sump drains in the main tanks were coated with sloshing compound. The fuel tank outlet screens were also partially coated, and sealant affected the normal operation of a fuel selector ball check valve.

On August 1, 1976, a Piper PA-32, N3223W, serial No. 32-30, lost engine power during the final approach to the Nut Tree Airport, Vacaville, California. Investigation disclosed that the bottoms of the carburetor accelerator pump and discharge nozzle were coated and clogged with a white substance. The bottom of the mixture control also contained foreign matter.

On November 27, 1977, a PA-28-140, N38478, serial No. 28-772583, was involved in a similar approach accident at Travis Air Force Base. The investigation disclosed that the gascolator fuel screen was covered with a white substance and white flakes were evident in the fuel tanks.

In view of the continued existence of sloshing compound deterioration on Piper PA-28 and PA-32 model aircraft in spite of AD-67-26-3 and in spite of a change in sloshing compound, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive similar to AD 67-26-3 for all Piper PA-28 and PA-32 aircraft to require that the interior surfaces of both main fuel tanks are inspected for evidence of sealant deterioration. This inspection should be repeated at prescribed intervals to insure continued airworthiness of the aircraft until a permanent solution to the problem of fuel-tank sealant deterioration is resolved. (Class II Priority Action) (A-78-76)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, and HOGUE, Members, concurred in the above recommendation.

James B. King

By: James B. King
Chairman

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

MAY 13 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Reference is made to the Federal Aviation Administration's (FAA) letter dated April 17, 1981, further responding to National Transportation Safety Board Safety Recommendations A-78-78 issued October 18, 1978, and A-78-80 and -81 issued October 26, 1978. This letter is in answer to your response to A-78-78. Our comments to the separate greensheet recommendations A-78-80 and -81 are being forwarded separately.

In A-78-78 we recommended that the FAA review procedures at all airports which are used regularly by air carrier and general aviation aircraft to determine which other areas require either a terminal control area or a terminal radar service area, and establish the appropriate one. We note that 137 Terminal Radar Service Areas (TRSA) have been established and 26 other TRSAs are under review. Also, as a followup to Notice of Proposed Rulemaking 78-19, two new Terminal Control Areas (TCA) have been established at San Diego and Honolulu and another 31 TCA locations are under review. We agree that these ongoing actions satisfy the intent of Safety Recommendation A-78-78 which we now classify in a "Closed--Acceptable Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

April 17, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-78-78 issued October 18, 1978, and A-78-80 and 81 issued October 26, 1978. These recommendations were issued as a result of the Board's investigation of several separate midair collisions which occurred during calendar year 1978. We note that related Safety Recommendation A-78-77 was classified in a "Closed--Acceptable Action" status on July 3, 1979, and A-78-79 was classified in a "Closed--Acceptable Action" status on February 26, 1979. This response, therefore, addresses Safety Recommendations A-78-78, 80, and 81.

A-78-78. Review procedures at all airports which are used regularly by air carrier and general aviation aircraft to determine which other areas require either a terminal control area or a terminal radar service area, and establish the appropriate one.

FAA Comment. The review of all airports to determine their need for a Terminal Radar Service Area (TRSA) is well underway. Since January 1979, we have established 48 TRSA's, bringing the total number to 137. There are 26 other locations still under consideration. Also, revised guidelines are being finalized that will permit regional offices and individual facilities to identify additional locations as TRSA candidates. As a followup to Notice of Proposed Rulemaking (NPRM) 78-19, two new Terminal Control Areas (TCA's) have been implemented at San Diego and Honolulu. Another 31 locations are still being considered as candidate sites for TCA's.

We believe this ongoing program satisfies the intent of Safety Recommendation A-78-78. Accordingly, the Federal Aviation Administration (FAA) considers action on this recommendation completed.

A-78-80. Evaluate operational data for each TRSA location and establish two categories of TRSA's. Those locations handling the largest volume of traffic with automated ATC equipment available should be designated TRSA I locations. The remaining areas would be designated TRSA II locations.

FAA Comment. The NTSB recommendation to create two levels of TRSA's encompasses the existing TCA/TRSA criteria and creates an additional level of service. We believe that implementation of this recommendation would add considerable confusion to the present TCA/TRSA concept. We are confident that our efforts to increase the number of TCA's and TRSA's, as described in the response to A-78-78, satisfy the intent of Safety Recommendation A-78-80. Accordingly, the FAA considers action on this recommendation completed.

A-78-81. Require Mode "C" transponder equipment for operations within a TRSA I and Group II TCA and require that a pilot of a VFR flight traversing a TRSA I establish radio contact with the appropriate ATC facility before entering the designated airspace.

FAA Comment. NPRM 78-19 included provisions for upgraded transponder equipment. Following the public response period, the decision was made to follow the course of action described in the response to A-78-78. Inherent in that effort to increase the number of Group II TCA's is the requirement for transponder equipment where none now exist. We believe these efforts satisfy the intent of Safety Recommendation A-78-81. Accordingly, the FAA considers action on this recommendation completed.

Sincerely,

Charles E. Weithoner
Acting Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

MAR - 4

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Please refer to the National Transportation Safety Board's Safety Recommendations A-78-79 through -81 issued October 26, 1978. By letter dated February 26, 1979, we advised the Federal Aviation Administration that A-78-79 was classified "Closed - Acceptable Action." In order to evaluate the progress of A-78-80 and -81, we request an updated status report. Related Recommendations A-78-82 and -83, issued on a separate greensheet and mentioned in your letters of January 9, 1979, and July 1, 1980, are being dealt with separately.

Sincerely yours,

James B. King

James B. King
Chairman

Office of the
Chairman

**National Transportation
Safety Board**

Washington, D.C. 20594

February 26, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to your letter of January 9, 1979, responding to safety recommendations A-78-79 through A-78-83. These recommendations stemmed from the midair collisions between a Falcon Jet and a Cessna 150 at Memphis, Tennessee, on May 18, 1978, and between a Boeing 727 and Cessna 172 at San Diego, California, on September 25, 1978. Our comments to the Federal Aviation Administration's responses are as follows:

Recommendation A-78-79

We are pleased to note that procedures for handling consecutive approaches at Memphis have been established to fulfill the intent of the recommendation. The status of this is now classified as "Closed - Acceptable Action."

Recommendations A-78-80 through A-78-83

We appreciate the ongoing actions to satisfy these recommendations. They will be maintained in an open status pending their resolution.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

January 9, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Ave., S.W.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to your safety recommendations A-78-79 through A-78-83.

Recommendation A-78-79. Evaluate the closed traffic pattern operations conducted at Memphis International Airport and consider establishment of a procedure whereby high performance or turbine jet aircraft conducting multiple approaches for training purposes be assigned an altitude of 2,500 feet or above, which would place responsibility for control of the aircraft with TRACON personnel.

Comment. Procedures for handling consecutive approaches at Memphis have been formalized and instituted to:

1. Require coordination of any consecutive approach prior to the aircraft crossing the approach end of the runway. In the event coordination is not approved, the aircraft is climbed to 3000 feet and handled as a departure.

2. Require aircraft conducting multiple practice approaches to climb straight ahead to 3500 feet with control responsibility transferred to the TRACON, unless otherwise coordinated.

Recommendation A-78-80. Evaluate operational data for each TRSA location and establish two categories of TRSA's. Those locations handling the largest volume of traffic with automated ATC equipment available should be designated TRSA I locations. The remaining areas would be designated TRSA II locations.

Comment. We have issued a Notice of Proposed Rule Making (NPRM), which we believe will meet or exceed the intent of your recommendation without adding additional categories of airspace or control services. We believe the latter is necessary to facilitate pilot and public understanding of the system and the various levels of service provided.

Recommendation A-78-81. Require Mode "C" transponder equipment for operations within a TRSA I and Group II TCA and require that a pilot of a VFR flight traversing a TRSA I establish radio contact with the appropriate ATC facility before entering the designated airspace.

Comment. We will be issuing an advanced NPRM in the near future in order to upgrade altitude encoding requirements. Our Notice of Proposed Rule Making discussed under Recommendation A-78-80 will permit us to accomplish the intent of this recommendation.

Recommendation A-78-82. Use visual separation in terminal control areas and terminal radar service areas only when a pilot requests it, except for sequencing on the final approach with radar monitoring.

Comment. The total use of visual separation which is permitted only in the terminal environment is currently under study by a task group composed of FAA headquarters, field personnel and Department of Defense (DOD) representatives. All recommendations for changes resulting from this group will be submitted to all aviation interests, including the NTSB, prior to May 1, 1979.

Recommendation A-78-83. Reevaluate its policy with regard to the use of visual separation in other terminal areas.

Comment. The study referred to in comment to Recommendation A-78-82 includes a reevaluation of our policy regarding use of visual separation in other terminal areas.

We will keep you apprised of our progress in:

1. The upgrading and expansion of TCAs.

2. The modification of our policy relative to visual separation in terminal areas.

Sincerely,

Quentin S. Taylor

Quentin S. Taylor
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: October 26, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

A-79 through -81

At 1210 on May 18, 1978, N6423K, a Cessna 150, and N121GW, a Falcon Fan Jet, collided in midair about 3 1/2 miles west of Memphis International Airport, Memphis, Tennessee. At the time of the collision both aircraft were operating under the control jurisdiction of Memphis Tower at an assigned altitude of 2,000 feet m.s.l. and were in radio/radar contact with different facility controllers on separate radio frequencies. Visual meteorological conditions prevailed at the time.

Investigation disclosed that N6423K was a VFR arrival from the west and was receiving stage III radar service; N121GW was operating in a closed traffic pattern on an IFR flight plan and was conducting multiple ILS approaches to runway 17R. Further, investigation revealed that ATC failed to effect the required separation minima applicable to known VFR and IFR traffic operating within the designated terminal radar service area (TRSA), because controller personnel responsible for the control of the two aircraft did not coordinate the particular operation being conducted with each other. As a result of this lack of coordination, neither of the two controllers controlling N121GW had any knowledge that N6423K was inbound traffic, and the third controller, who was providing control service to N6423K, had no knowledge of N121GW's traffic pattern operation within his airspace at 2,000 feet. Therefore, no one recognized that a conflict existed until the two aircraft were seen on radar about 1 mile apart. At that point, insufficient time was available for corrective action.

The Safety Board is concerned that a single coordination procedural error effectively negated the control capability of an ATC system which utilizes modern automated radar equipment and procedural concepts. Therefore, we have examined facility procedures, automated equipment,

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and TRSA requirements carefully to determine (1) if additional safeguards are feasible and (2) how such measures would have prevented this accident. Based on our analysis of ATC operations, we conclude that there are two problem areas worthy of corrective action. The first area involves the local operating procedures used at Memphis for closed traffic pattern IFR operations, and the second involves the current rules for aircraft operations in a TRSA and related transponder requirements.

Both aircraft were being controlled in accordance with prescribed procedures and standard practices at an assigned altitude of 2,000 feet. The airspace within a 5-mile radius of the airport, from the surface to 2,000 feet, is designated for and utilized by the facility for local control operations. Thus, responsibility for the control of air traffic within that airspace is the responsibility of the local controllers (LC 1 and 2). To effect procedural control, the LC-1 controller is responsible for traffic operating in the east and west quadrants of a 5-mile circle around the airport which are formed by bisecting lines NW/SE and NE/SW that pass through the center of the airport. The LC-2 controller is responsible for traffic operating in the north and south quadrants. Any traffic operating in a closed traffic pattern at 2,000 feet or below will traverse the airspace of both the LC-1 and LC-2 controllers. Every circuit of the closed traffic pattern for runway 17R at Memphis requires coordination between the LC-2 and LC-1 controllers to acquire knowledge of mutual traffic and potential conflicts. Also, these controllers are obligated to separate traffic in accordance with applicable criteria for TRSA traffic.

The Safety Board believes that closed traffic pattern operations at Memphis International Airport should be discontinued within the designated airspace for local control operations. The additional workload imposed on local controllers by the requirement to coordinate and effect stage III/ IFR separation minima between these aircraft compromises their ability to perform their primary duties. Since the physical layout of the Memphis Airport and control procedures utilized by the facility are somewhat unique, the Safety Board believes that ideally any closed traffic pattern operation wherein the aircraft will be executing multiple ILS approaches should be conducted at an assigned altitude of 2,500 feet or above. Appropriate radar control personnel in the TRACON are better suited to provide radar separation service than the local controller. Accordingly, control responsibility should be transferred to Memphis TRACON.

The Safety Board is extremely concerned by existing requirements for an aircraft transponder for flight operations in certain designated controlled airspace. We understand that a transponder with altitude encoder is required for flight operations conducted above 12,500 feet m.s.l. and within designated group I TCA's. Group II-type TCA's require a transponder without altitude encoder. Such equipment is not required for flight within a designated TRSA, nor is there any requirement that a pilot establish radio contact with ATC when traversing a TRSA.

Based on its investigation of this accident, the Safety Board concludes that the transponder requirements for flight operations within a TRSA and TCA II should be revised. In view of the ever increasing availability of ATC automated equipment and the future development of Beacon Collision Avoidance System, Discreet Address Beacon System, and Automated Traffic Advisory and Resolution Service (ATARS), we believe that failure to reevaluate the operational benefits and safety enhancement the altitude encoder Mode "C" transponder could provide in TRSA and TCA II operations would be untenable.

It is evident to the Board that if an operating transponder had been installed aboard Cessna 6423K identification of that aircraft with altitude data would most likely have been detected by controller personnel and the accident would not have occurred. At locations where the conflict alert system is operational, a Mode "C" transponder would provide another safeguard which could serve to prevent the type of accident that occurred at Memphis.

With respect to those civil airports that have a designated TRSA with stage III service provided, the Safety Board recognizes that traffic operations differ greatly between such airports as Phoenix, Arizona, and Roanoke, Virginia. Because some of the larger airports, such as Phoenix, now generate high volume traffic which closely approximates the criterion used for the establishment of a TCA II, we believe that TRSA locations should be classified into two groups based upon traffic count and carrier operations. Like the TCA's they could be classified as TRSA I & TRSA II locations. We believe that TRSA I locations with the higher volume traffic and ATC automation should require (1) a Mode "C" transponder to conduct flight operations within the TRSA and (2) VFR aircraft operating en route through the TRSA to establish radio communication with ATC before entering the TRSA. Because of the large number of transponder equipped aircraft that operate from the airports affected by the change in existing transponder requirements recommended, we believe such action feasible, timely, and justified in the interest of safer flight operations.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Evaluate the closed traffic pattern operations conducted at Memphis International Airport and consider establishment of a procedure whereby high performance or turbine jet aircraft conducting multiple approaches for training purposes be assigned an altitude of 2,500 feet or above, which would place responsibility for control of the aircraft with TRACON personnel. (Class II, Priority Action)(A-78-79.)

Evaluate operational data for each TRSA location and establish two categories of TRSA's. Those locations handling the largest volume of traffic with automated ATC equipment available should be designated TRSA I locations. The remaining areas would be designated TRSA II locations (Class II, Priority Action)(A-78-80.)

Require Mode "C" transponder equipment for operations within a TRSA I and Group II TCA and require that a pilot of a VFR flight traversing a TRSA I establish radio contact with the appropriate ATC facility before entering the designated airspace. (Class II, Priority Action)(A-78-81.)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and HOGUE, Members, concurred in the above recommendations.

By: James B. King
Chairman

National Transportation
Safety Board

Washington D.C. 20594

Office of the
Chairman

July 3, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of May 29, 1979, responding to recommendations A-78-77 and A-78-78. These recommendations stemmed from the midair collision between a Pacific Southwest Airlines B-727 and a Cessna 172 over San Diego, California, on September 25, 1978. In A-78-77, the Safety Board recommended that the Federal Aviation Administration (FAA) establish a Terminal Radar Service Area (TRSA) at Lindbergh Airport, San Diego, California. We are pleased to note that a TRSA has been established. The status of this recommendation is now classified as "Closed--Acceptable Action."

In A-78-78, the Safety Board recommended that the FAA review procedures at all airports to determine which other areas require either a Terminal Control Area (TCA) or a TRSA and to establish the appropriate one. We have examined FAA's "Plan for Enhanced Safety of Flight Operations in the National Airspace System," which describes in detail plans for 44 additional TCAs and 80 new TRSAs within the next 4 to 5 years. We have noted many related projects in the plan to minimize the midair collision problem. We appreciate the many actions underway toward fulfillment of this recommendation and request that we be kept periodically advised of their progress. The status of this recommendation is classified as "Open--Acceptable Action."

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 29, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

The following information updates the action taken by the Federal Aviation Administration (FAA) concerning NTSB Safety Recommendations A-78-77 and A-78-78.

Recommendation A-78-77. Implement a Terminal Radar Service Area (TRSA) at Lindbergh Airport, San Diego, California.

Comment. A TRSA was implemented at Lindbergh Airport, San Diego, California, on April 19. In addition, the airport traffic control tower has been equipped with the following:

BRITE Alphanumerics - commissioned 1/22/79

Minimum Safe Altitude Warning and Conflict Alert Enhancements - commissioned 2/14/79

Recommendation A-78-78. Review procedures at all airports which are used regularly by air carrier and general aviation aircraft to determine which other areas require either a terminal control area or a terminal radar service area and establish the appropriate one.

Comment. In our letter of December 27, 1978, we informed your office that the FAA's program to expedite the on-going TRSA establishment program at all air carrier airports, where capability exists, was well underway and that a Notice of Proposed Rule Making (NPRM) concerning establishment of additional Terminal Control Areas (TCA) was to be issued prior to January 1, 1979. This NRPM (Docket 18605) was issued January 4. See Enclosure 1.

As a matter of information, I have enclosed a copy of FAA's "Plan for Enhanced Safety of Flight Operations in the National Airspace System" which describes in detail our action for the establishment of additional TCAs and TRSAs with the proposed implementation dates. See Enclosure 2.

The FAA considers action completed with regard to these two recommendations.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosures

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

December 27, 1978

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Ave., S.W.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to your October 18 letter concerning the Federal Aviation Administration's (FAA) action relating to NTSB Recommendations A-78-77 and A-78-78.

Recommendation A-78-77. Implement a Terminal Radar Service Area (TRSA) at Lindbergh Airport, San Diego, California.

Comment. A TRSA serving the Lindbergh Field Airport is currently being established. Projected target date for implementation is May 1, 1979.

Recommendation A-78-78. Review procedures at all airports which are used regularly by air carrier and general aviation aircraft to determine which other areas require either a terminal control area or a terminal radar service area, and establish the appropriate one.

Comment. A program is well underway to expedite the on-going TRSA establishment program at all air carrier airports, where capability exists. A Notice of Proposed Rule Making (NPRM) concerning establishment of additional terminal control areas will be issued prior to January 1, 1979.

We will advise you of further action taken as it occurs.

Sincerely,

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: October 18, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-78-77 and 78

On September 25, 1978, Pacific Southwest Airlines Flight 182 and a Cessna 172, N7711G, collided in midair over San Diego, California. Flight 182 was on an instrument flight rules flight plan and had been cleared for a visual approach to runway 27 at Lindbergh Airport. The Cessna, which was on a visual flight rules (VFR) flight plan, had completed a practice instrument landing system approach to runway 9 at Lindbergh Airport and was proceeding northeast. When the collision occurred Flight 182 was communicating with Lindbergh tower, while the Cessna was communicating with the Miramar Radar Air Traffic Control Facility (RATCF).

Investigation has revealed that a Terminal Radar Service Area (TRSA) with Stage III service (radar sequencing and separation service for VFR aircraft) had been established at Miramar Naval Air Station, the primary airport in the San Diego, California, terminal area. Only Stage II service (radar advisory and sequencing for VFR aircraft) is available at Lindbergh Airport, which is classified as a secondary airport. Because of the mixture of air carrier and general aviation aircraft operating in and out of Lindbergh Airport, the Safety Board believes that a TRSA should be implemented for that airport so that other users can benefit from the same level of air traffic control service as is afforded military flights in the San Diego terminal area.

We realize that a TRSA may not have prevented the midair collision between Flight 182 and N7711G since visual separation is still being used in all terminal areas. Nevertheless, we believe that a TRSA would lessen the probability of a midair collision and would be a logical first step toward equalizing the ATC services available to all users of airspace in the San Diego terminal area.

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Consequently, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Implement a Terminal Radar Service Area (TRSA) at Lindbergh Airport, San Diego, California. (Class I - Urgent Action) (A-78-77)
>
> Review procedures at all airports which are used regularly by air carrier and general aviation aircraft to determine which other areas require either a terminal control area or a terminal radar service area, and establish the appropriate one. (Class II - Priority Action) (A-78-78)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and HOGUE, Members, concurred in the above recommendation.

By: James B. King
for Chairman

U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

JUN 29 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-78-82 and A-78-83 issued October 26, 1978. These recommendations were classified in an "Open--Unacceptable Action" status in correspondence dated April 6, 1981.

A-78-82. Use visual separation in terminal control areas and terminal radar service areas only when a pilot requests it, except for sequencing on the final approach with radar monitoring.

A-78-83. Reevaluate its policy with regard to the use of visual separation in other terminal areas.

FAA Comment. We have again reviewed Safety Recommendations A-78-82 and A-78-83 and remain convinced that to rely on pilots' requests before applying visual separation would have an adverse impact on the efficient use of airspace at many terminals. Moreover, we believe that increased delays in Terminal Radar Service Areas (TRSA) would cause many pilots to decline participation in Stage III services. Nonparticipating aircraft in Stage III TRSA environments can increase the risk of collisions.

To achieve optimum levels of safety and efficiency, every means of separation is used. Visual separation is a proven concept, and the pilot already has the prerogative to refuse this type of separation at any time. Visual separation when applied within the strict parameters outlined in Handbook 7110.65B, paragraph 490, enables the ATC system to safely minimize fuel-wasting delays. We have implemented procedural changes and amended the Airman's Information Manual (AIM) as follows:

1. On October 1, 1980, Handbook 7110.65B, paragraph 490, was revised as follows:

   a. Controllers are now required to inform the pilot about the other aircraft including position, direction, and, unless obvious, the other pilot's intentions.

b. The controller is now required to obtain an acknowledgment from the pilot that the other aircraft is in sight.

c. The controller is now required to advise the pilot if radar targets are likely to converge.

2. In January of this year, paragraphs 274 and 411 of the AIM (copies enclosed) were amended to further explain pilot responsibility and authority regarding visual separation.

In summary, the comments contained in our letter of July 1, 1980, are still valid and the Federal Aviation Administration considers action completed on Safety Recommendations A-78-82 and A-78-83.

Sincerely,

J. Lynn Helms
Administrator

Enclosures

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: October 26, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-78-82 and 83

On September 25, 1978, Pacific Southwest Airlines Flight 182, a Boeing 727-214, and N7711G, a Cessna 172, collided in midair over San Diego, California; 144 persons died as a result. Both aircraft were communicating with air traffic control (ATC) on different frequencies. Stage II service (radar advisory and sequencing for VFR aircraft) was being provided. In response to one of several traffic advisories issued by ATC, the pilot of Flight 182 commented, "Think he's passing off to our right."

On June 28, 1974, Rocky Mountain Airways Flight 323, a deHavilland DHC-6 Twin Otter, and N8105R, a Beech BE-35 Bonanza, collided in midair over Denver, Colorado; there were no fatalities. Both flights were communicating with the Denver tower at the time. The tower cab was equipped with a BRITE-1 video display,and the controller had both airplanes in visual contact when they collided in the Denver terminal control area. Immediately before the collision, the Bonanza pilot assured ATC that he had the Twin Otter in sight.

On December 4, 1971, Eastern Airlines Flight 898, a McDonnell-Douglas DC9-31, and N2110F, a Cessna 206, collided in midair near Raleigh-Durham Airport, North Carolina. The two occupants of the Cessna 206 were killed. Both flights were communicating with Raleigh-Durham tower when they collided . The tower cab was not equipped with radar. In response to a traffic advisory issued by the tower, the air carrier pilot commented, "We just went over the top of him there."

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Although the circumstances surrounding these midair collisions were different, they have one element in common -- in each case, controllers were applying visual separation. Visual separation is a means which may be employed by ATC to separate aircraft in terminal areas. Upon instruction from ATC, a pilot who sees another involved aircraft provides his own separation by maneuvering his aircraft, if necessary, to avoid the other aircraft. When ATC instructs a pilot to employ visual separation, he must keep the other aircraft in sight until it is no longer a factor, as should have been the case at San Diego, or he must follow in line behind another aircraft, as should have been the case at Denver and Raleigh-Durham.

The Safety Board realizes that the visual separation technique is usually effective; however, because of the human limitation and other restrictive factors, it can never be considered completely reliable.

In the three accidents cited, visual separation could have been supplemented by more positive separation methods if controllers had chosen to use them. The Safety Board concludes that more positive separation methods must be used to the maximum extent possible in terminal control areas and in terminal radar service areas.

Consequently, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Use visual separation in terminal control areas and terminal radar service areas only when a pilot requests it, except for sequencing on the final approach with radar monitoring. (Class I, Urgent Action) (A-78-82)
>
> Reevaluate its policy with regard to the use of visual separation in other terminal areas. (Class II, Priority Action) (A-78-83)

KING, Chairman, DRIVER. Vice Chairman, and McADAMS and HOGUE, members, concurred in the above recommendations.

By: James B. King
Chairman

U.S. Department
of Transportation

**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave. S.W.
Washington, D.C. 20591

May 29, 1981

The Honorable James B. King
Chairman, National Transportation
  Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-78-84 through A-78-89, and supplements our letter of February 15, 1979. This also responds to your letter of September 23, 1980, in which you requested a further report of actions taken.

A-78-84. Review and revise the accelerate-stop criteria required to be demonstrated during aircraft certification and used during operations to insure that they consider the effects of wet runway conditions and the most frequent and critical causes of rejected takeoffs.

FAA Comment. The Federal Aviation Administration (FAA) is contemplating a public technical review during the latter part of the year to solicit comments on and consider operational and certification rule changes to the takeoff and accelerate-stop distance requirements for transport category airplanes. The review will consider all factors affecting takeoff and accelerate-stop distance including wet runway accountability and mandatory requirements for anti-skid systems. Associated factors such as line-up distance, decision speeds, automatic braking systems, reduced thrust, reverse thrust, and screen height will be discussed. We will inform the Board of our findings as a result of this review.

A-78-85. Evaluate, with industry, the British CAA wet runway normal and rejected takeoff requirements for applicability as a U.S. standard.

FAA Comment. The British CAA wet runway normal and rejected takeoff requirements differ from present U.S. standards, in that CAA requirements account for stopping on a Reference Wet Hard Surface, permit credit for reverse thrust, and accept a takeoff distance to a height of 15 feet in lieu of 35 feet required by Federal Aviation Regulations. Each of these differences involves highly controversial and complex issues upon which FAA and CAA have adopted different positions.

The CAA requirements define a Reference Wet Hard Surface in terms of a friction level measured by a ground vehicle called the Road Research Laboratory Skidding (Miles) Trailer. Aircraft stopping tests are performed on a runway wetted to approximate a friction level defined by the British Civil Airworthiness Requirements (BCAR). Measurements using the Miles Trailer are made before and after the aircraft test run so that the friction level of the runway can be determined for the time of the actual aircraft test. If the runway friction, as measured by the Miles Trailer, for the test does not match the Reference condition, aircraft stopping performance data are corrected to the reference condition by the ratio of test to reference Miles Trailer Friction levels.

The key to this method is the Miles Trailer. We have been informed by the CAA that the special tires used on the Miles Trailer are no longer available; therefore, the Reference Wet Hard Surface defined in the BCAR's is not usable.

Additionally, certain conclusions were reached by numerous experts in the field of runway friction definition in an International Civil Aviation Organization (ICAO) study group. Specifically, it was concluded that readings of the ground measuring devices do not correlate with each other or with the stopping performance of aircraft due to the numerous interacting variables involved.

In view of the above, the FAA does not believe it appropriate to consider the CAA wet runway takeoff requirements for applicability as a U.S. standard. Accordingly, we do not intend to pursue this effort further.

A-78-86. Revise Advisory Circular 121-14 to provide guidance on (1) programming aircraft simulators to account for the degradation of aircraft deceleration performance on wet runways during landings and rejected takeoffs and (2) installing instrumentation to enable evaluation of pilot performance during RTO's on critical length runways, particularly the response times in activating stopping devices and the level of brake application to insure that such performance is compatible with a minimum-distance stop.

FAA Comment. In our letter of February 15, 1979, we advised the Board that Advisory Circular (AC) 121-14, Aircraft Simulator and Visual System Evaluation and Approach, was amended on October 16, 1978. Page 13, paragraph 13.b(13), of AC 121-14B specifically asks that the air carriers program their simulators to include the effects of runway contaminants as they affect directional control and stopping distance, including the rejected takeoff (RTO) phase.

FAA representatives have met with the Air Transport Association of America (ATA) Training Committee concerning ATA's evaluation of this recommendation. Further specific requirements concerning this recommendation were

established in AC 121-14C, Appendix 1, dated August 29, 1980. A copy of this advisory circular is enclosed. The FAA considers action on Safety Recommendation A-78-86 completed.

A-78-87. Insure that pilot training programs include appropriate information regarding optimum rejected takeoff procedures at maximum weights, on wet and dry runways, and at speeds at or near V_1, and for rejected takeoffs which must be initiated as a result of engine or tire failures.

FAA Comment. As we informed the Board in our February 15, 1979, letter, Telegraphic Notice 8430.306, Maximum Deceleration Rejected Takeoffs, was issued on October 28, 1978. Through this notice, each principal operations inspector was required to establish, with his air carrier, a simulator training program consisting of maximum deceleration rejected takeoffs with continuing special emphasis on this maneuver during pilot proficiency and certification checks. This maneuver, as recommended by the Board, was required to be conducted on critical runways under the most adverse conditions.

FAA also discussed this recommendation with the ATA Training Committee. The ATA supports this training.

An air carrier operations bulletin was developed on November 25, 1980, to keep Notice 8430.306 in force on a continuing basis. A copy of this document is enclosed. The FAA considers action on Safety Recommendation A-78-87 completed.

A-78-88. Encourage operators of turbine engine-powered aircraft to include in flight manuals the maximum use of aircraft deceleration devices when an RTO is initiated at or near decision speed (V_1) on wet or dry runways of critical length.

FAA Comment. In addition to those actions described in our February 15, 1979, letter, we issued Notice 8430.318, Balanced Field Rejected Takeoffs, on July 30, 1979. This Notice directs principal operations inspectors to encourage operators of turbine-powered aircraft to include in their flight manuals the maximum use of deceleration devices when an RTO is initiated at or near decision speed (V_1) on wet or dry runways of critical length and to continue the RTO training initiated by Notice 8430.306. A copy of Notice 8430.318 is also enclosed. The FAA considers action on Safety Recommendation A-78-88 completed.

A-78-89. Develop and publish an Advisory Circular, or include in other appropriate documents available to air carrier and other pilots, general accelerate-stop performance data for RTO's on wet runways necessitated by engine and tire failures. Emphasize the need for maximum braking procedures when an RTO is required at high gross weights and speeds.

FAA Comment. In our initial response to this recommendation, we stated that the FAA was working with NASA-Langley to develop data that can be programmed into a simulator and will accurately reflect failed tire and contaminated runway effects on aircraft.

Data acquisition and evaluation took somewhat longer than originally anticipated. However, the Air Transport Association has completed data evaluation and will discuss their conclusions with the FAA on June 23, 1981.

We will keep the Board informed of further action taken in response to Safety Recommendation A-78-89.

Sincerely,

J. Lynn Helms
Administrator

Enclosures

National Transportation
Safety Board

Washington, D.C. 20594

Office of
Chairman

SEP 23 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Please refer to your letter of February 15, 1979, and our response of March 12, 1979, regarding National Transportation Safety Board Safety Recommendations A-78-84 through 89 issued November 17, 1978. These recommendations emanated as a result of a Continental Airlines DC-10 accident at Los Angeles International Airport on March 1, 1978. During the takeoff run, two tires suddenly blew out on the left main gear, and the aircraft crashed off the end of the runway.

Your letter indicated several actions were in progress toward resolution of these recommendations. In order to evaluate their progress and update the public docket, we would appreciate a further report of actions taken.

Sincerely yours,

James B. King
James B. King
Chairman

Office of the
Chairman

**National Transportation
Safety Board**

Washington D C 20594

March 12, 1979

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter dated February 15, 1979, responding to safety recommendations A-78-84 through 89. These recommendations emanated as a result of a Continental Airlines DC-10 accident at Los Angeles International Airport on March 1, 1978. During the take-off run, two tires suddenly blew out on the left main gear and the aircraft crashed off the end of the runway.

The National Transportation Safety Board is pleased to note that the Federal Aviation Administration has initiated action toward implementation of these six recommendations. They are being held in an "Open - Acceptable Action" status pending their resolution.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

February 15, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-78-84 through 89.

A-78-84. Review and revise the accelerate-stop criteria required to be demonstrated during aircraft certification and used during operations to insure that they consider the effects of wet runway conditions and the most frequent and critical causes of rejected takeoffs.

Comment. Flight Standards personnel and the airlines have recently been briefed by the Douglas Aircraft Company, the Lockheed Corporation, and the Boeing Company concerning criteria they have developed which is designed to reduce accelerate-stop distances on wet runways. We believe this plan has merit and we will meet very soon with the manufacturers to review this plan in greater detail. At this time, neither the air carriers nor the FAA have had sufficient opportunity to fully consider this proposal. We will advise you further in this regard.

A-78-85. Evaluate, with industry, the British CAA wet runway normal and rejected takeoff requirements for applicability as a U. S. standard.

Comment. We will consider the British CAA rules in our review of accelerate-stop criteria with the manufacturers.

A-78-86. Revise Advisory Circular 121-14 to provide guidance on (1) programming aircraft simulators to account for the degradation of aircraft deceleration performance on wet runways during landings and rejected takeoffs and (2) installing instrumentation to enable evaluation of pilot performance during RTO's on critical length runways, particularly the response times in activating stopping devices and the level of brake application to insure that such performance is compatible with a minimum-distance stop.

Comment. We have efforts underway to encourage air carriers to upgrade their simulators. Federal Aviation Regulations Section 121.439 has been amended and two exemptions have been issued to permit air carriers to increase the use of any simulator which has been upgraded and approved for the landing maneuver.

This upgrading includes ground handling programming and hardware modifications which are essential for rejected takeoff situations. The landing maneuver program is designed to upgrade simulators in order that positive training in rejected takeoffs and windshear situations can be given. Advisory Circular (AC) 121-14, "Aircraft Simulator and Visual System Evaluation and Approach," was amended on October 16, 1978, to reflect this program. Page 13, paragraph 13.b(13) of AC 121-14B specifically asks that the air carriers program their simulators to include the effects of runway contaminants as they affect directional control and stopping distance.

The Air Transport Association of America (ATA) Training Committee has evaluated this recommendation and wishes to brief our Flight Standards people on some of their ideas for approving aircraft simulators for training to account for performance derogation during takeoffs and landings on wet runways. Accordingly, we plan to meet with them in the very near future and again will respond further to you on this recommendation.

A-78-87. Insure that pilot training programs include appropriate information regarding optimum rejected takeoff procedures at maximum weights, on wet and dry runways, and at speeds at or near V1, and for rejected takeoffs which must be initiated as a result of engine or tire failures.

A-78-88. Encourage operators of turbine engine-powered aircraft to include in flight manuals the maximum use of aircraft deceleration devices when an RTO is initiated at or near decision speed (V1) on wet or dry runways of critical length.

Comment. We issued Telegraphic Notice N8430.306, "Maximum Deceleration Rejected Takeoffs," on October 28, 1978. This Notice requires each air carrier principal operations inspector to review his assigned air carrier's simulator training program and assure that the RTO maneuver for turbojet-powered airplanes is initiated on a runway where the length is critical, the airplane is at maximum gross takeoff weight and at a speed just under V1. The Notice also makes the RTO maneuver a special emphasis item for all pilot certification and proficiency checks. However, we will discuss this recommendation with the ATA Training Committee and may revise the Notice 8430.306 if appropriate.

A-78-89. Develop and publish an Advisory Circular, or include in other appropriate documents available to air carrier and other pilots, general accelerate-stop performance data for RTO's on wet runways necessitated by engine and tire failures. Emphasize the need for maximum braking procedures when an RTO is required at high gross weights and speeds.

Comment. The FAA, in cooperation with NASA Langley, is working to develop data which accurately reflect failed tire and contaminated runway effects on aircraft and which can be programmed into a simulator. We are following the NASA work very closely to determine if the data can be programmed into airline simulators.

Copies of AC 121-14B and Telegraphic Notice (GENOT) N8430.306 are enclosed.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

2 Enclosures

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: November 17, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-78-84 through -89

On March 1, 1978, a Continental Airlines DC-10 crashed off the end of runway 6R at Los Angeles International Airport after two tires suddenly blew out on the left main gear at an airspeed slightly below V_1. Although the crew promptly rejected the takeoff before V_1 was attained and used all of the available deceleration devices, the aircraft overran the end of the wet, grooved 10,285-foot runway at 68 knots.

The Safety Board believes that this accident illustrates a number of shortcomings in the certification of aircraft and in the training of aircrews to effectively accomplish rejected takeoffs under the most critical conditions of speed, weight, runway condition, and the reasons for initiating rejected takeoffs.

14 CFR 25, "Airworthiness Standards: Transport Category Airplanes," defines the certification requirements for normal and rejected takeoffs (RTO). The associated takeoff speeds and accelerate-stop distances are predicated on recognition of an engine failure at V_1 on a smooth, dry, and hard-surfaced runway. These requirements do not address the accident conditions of failed tires and wet runway surfaces, each of which may add a considerable stopping distance increment to that presently required to be demonstrated during certification.

In contrast to the dry runway RTO certification stopping requirement, 14 CFR 121 provides an operational safety stopping margin for landings on wet runways. A landing aircraft is required to stop on a dry runway within 60 percent of the effective runway length. The runway length used for this calculation is increased by 15 percent for wet or slippery conditions. In effect, Part 121 establishes a wet runway length that is more than twice the distance demonstrated for stopping the aircraft during dry runway certification tests. However, even though Part 121 provides for corrections to takeoff weights, distances, and flightpaths

2335-C

required by density altitude, wind, and runway slope during normal and rejected takeoffs, it does not similarly require corrections for the added stopping distance required by rejected takeoffs initiated by engine or tire failures on wet or slippery runways.

A 1977 FAA report 1/ indicates that 87 percent of rejected takeoffs were caused by some failure or malfunction of tires, wheels and brakes. These data show that the engine failures have not been the dominant cause for some time. The stopping distance required for the aircraft will increase significantly as a result of tire, wheel, or brake failure wherein the ability to develop or transmit braking torque to the runway surface is reduced. Thus, although 87 percent of RTO's are a result of such failures, no consideration is given to their effect on stopping distance. The FAA report cites wet or slippery runway involvement in three major RTO accidents 2/ between 1964 and 1975. The FAA report recommends that "The increased accelerate-stop distance required on wet/slippery runways be taken into account in takeoff calculations and the necessary changes to airplane flight manuals, procedures, and regulations be incorporated to accommodate this." The Safety Board has determined that no FAA actions had been taken before the Continental accident concerning this recommendation.

In 1962, the British Civil Aviation Authority (CAA) changed the British Civil Airworthiness Requirements (BCAR), counterpart of Part 25, to account for the increased accelerate-stop distance necessitated by wet runways under engine-out conditions. The BCAR's define a wet runway reference surface that is used during landing and rejected takeoff certification testing. This standard represents an average wet, well-soaked surface which typifies the condition of runway 6R at the time of the Continental accident. There is no FAA counterpart to the BCAR wet runway standard, although U.S. manufacturers have been testing under the BCAR wet requirements in order to certificate airplanes in foreign countries. The V_1 data for wet runway conditions are determined from these tests and provided to foreign flightcrews. The BCAR procedures reduce the dry runway V_1 decision speeds so that an RTO initiated at the lower wet V_1 speed will allow the aircraft to stop on the wet runway as long as the actual surface condition is no worse than the reference surface. The BCAR also reduced the wet runway screen height requirement

1/ Jet Transport Rejected Takeoffs, Final Report, February 1977, Flight Standards Services, FAA.

2/ Trans World Airlines, Inc., B-707, N769TW, Fumicino Airport, Rome, Italy, November 23, 1964.
Capitol International Airways, Inc., DC-8-63F, N4909C, Anchorage, Alaska, November 27, 1970.
Overseas National Airways, Inc., Douglas DC-10-30, N1032F, John F. Kennedy International Airport, Jamaica, New York, November 12, 1975.

from 35 feet, the current FAA standard, to 15 feet. The BCAR, however, retained the requirement for the 35-foot screen height for takeoffs on dry runways. The screen height is the vertical distance above the runway where the takeoff safety airspeed (V_2) is reached with a failed engine. This reduction in screen height allows the wet runway length to be essentially the same as the dry length and, for the DC-10 type aircraft, imposes no weight penalty on the operator. The Safety Board did not attempt to evaluate the adequacy of the CAA approach, but we recognize that lower V_1 speeds or lower takeoff weights, or both, for wet runway conditions will improve aircraft stopping performance.

During the investigation of the Continental accident, the Safety Board learned that one DC-10 operator at Los Angeles has routinely and voluntarily accounted for the added wet runway stopping distance for over 5 years by reducing DC-10 V_1 speeds and takeoff weights. The reduction in weight is required because of the current FAA 35-foot screen height standard. For the Continental accident case, the wet V_1 speed would have been 149 knots, 7 knots lower than the dry V_1 speed (156 knots), and the takeoff weight would have been reduced by about 10,000 pounds. Under these conditions, a successful takeoff by the Continental DC-10 may have been possible. The operator has also applied wet runway corrections for Boeing 727/737 aircraft during the last 8 years for all airports that it serves.

The Safety Board's investigation of flightcrew training practices regarding RTO's revealed that most training is given in simulators under unrealistic conditions. For example, most simulated RTO's are not initiated at maximum takeoff weights and associated V_1 speeds, and few simulators have the capacity to measure the pilot's braking efficiency. In the latter respect, a simulation test conducted by NASA and Douglas Aircraft Company demonstrated that air carrier pilots who were told to apply maximum braking during simulated RTO's actually achieved this only 60 percent of the time.

The FAA acceptance standards for aircraft simulators used in pilot training are set forth in Advisory Circular 121-14, Aircraft Simulator Evaluation and Approval. This circular contains accuracy criteria for takeoff performance characteristics, but it does not contain deceleration criteria for dry, wet, or slippery runways. Additionally, it does not provide for the measurement of pilot response times or the amount of braking effort applied by pilots and achieved by the brakes to assess how well pilots are attempting to stop aircraft during high-energy RTO's on critical length runways.

Pilot training in actual RTO's requiring maximum energy stops is by necessity limited to discussion and simulation. In some cases, simulator training may provide a false sense of security to the pilot by reflecting airplane performance in excess of that actually available for stopping on wet runways. The Safety Board believes that, where simulators are used for such training, they should demonstrate the actual performance,

particularly where visual and acceleration cues are provided by the simulator. Furthermore, all simulators should be equipped with sufficient instrumentation to enable instructors to evaluate the pilot's performance in executing an RTO, particularly the response times in activating stopping devices, and the level of brake application to insure that such performance is compatible with a mininum-distance stop.

The RTO procedures in the Continental DC-10 flight manual specified that brakes should be applied "as required" after retarding the throttles to idle. Reverse thrust is to be applied "as required" following brake application. These procedures do not address an RTO initiated at or near V_1 speed and at maximum takeoff gross weights. In contrast to the Continental procedures, a Douglas DC-10 Newsletter issued in August 1977 discussed the emergency nature of RTO's initiated near V_1 speed and recommended using maximum brake pedal deflection, simultaneously selecting reverse thrust, and applying full reverse thrust as soon as possible.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Review and revise the accelerate-stop criteria required to be demonstrated during aircraft certification and used during operations to insure that they consider the effects of wet runway conditions and the most frequent and critical causes of rejected takeoffs. (A-78-84) (Class II - Priority Action)
>
> Evaluate, with industry, the British CAA wet runway normal and rejected takeoff requirements for applicability as a U.S. standard. (A-78-85) (Class II - Priority Action)
>
> Revise Advisory Circular 121-14 to provide guidance on (1) programming aircraft simulators to account for the degradation of aircraft deceleration performance on wet runways during landings and rejected takeoffs and (2) installing instrumentation to enable evaluation of pilot performance during RTO's on critical length runways, particularly the response times in activating stopping devices and the level of brake application to insure that such performance is compatible with a minimum-distance stop. (A-78-86) (Class II - Priority Action)
>
> Insure that pilot training programs include appropriate information regarding optimum rejected takeoff procedures at maximum weights, on wet and dry runways, and at speeds at or near V_1, and for rejected takeoffs which must be initiated as a result of engine or tire failures. (A-78-87) (Class II - Priority Action)

Encourage operators of turbine engine-powered aircraft to include in flight manuals the maximum use of aircraft deceleration devices when an RTO is initiated at or near decision speed (V_1) on wet or dry runways of critical length. (A-78-88) (Class II - Priority Action)

Develop and publish an Advisory Circular, or include in other appropriate documents available to air carrier and other pilots, general accelerate-stop performance data for RTO's on wet runways necessitated by engine and tire failures. Emphasize the need for maximum braking procedures when an RTO is required at high gross weights and speeds. (A-78-89) (Class II - Priority Action)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and HOGUE, Members concurred in the above recommendations.

James B. King

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

May 18, 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

This is in reference to the Federal Aviation Administration's (FAA) letter dated April 6, 1981, responding to National Transportation Safety Board Safety Recommendation A-79-2 issued February 2, 1979. Companion Safety Recommendation A-79-1 was earlier classified "Closed--Acceptable Action." These recommendations stemmed from a Hughes Model 269A helicopter accident at Vancouver, Washington, on May 2[illegible], 1978.

In Safety Recommendation A-79-2 we recommended that the FAA advise overhaul facilities and manufacturers that permanent identification of parts is required by 14 CFR 45.15. We note from page 3776 of the Federal Register dated January 15, 1981, that marking requirements are scheduled to be part of an FAA regulatory review, as stated in Notice of Proposed Rulemaking, Docket No. 17147, Notice 77-19C.

We appreciate the FAA's offer to keep the Safety Board informed of changes in the status of this recommendation which remains classified in an "Open--Acceptable Alternate Action."

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

April 6, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-79-1 and A-79-2 issued February 2, 1979. This also responds to your letter of October 23, 1980, in which you requested to be kept informed of progress toward resolution of Safety Recommendation A-79-2. In this letter the Federal Aviation Administration was informed that Safety Recommendation A-79-1 was classified in a "Closed--Acceptable Action" status by official Board action.

A-79-2. Advise overhaul facilities and manufacturers that permanent identification of parts is required by 14 CFR 45.15.

FAA Comment. Enclosed is a copy of the Federal Register, dated January 15. Please note that the review of marking requirements is scheduled to be part of the proposed regulatory review, as set forth in Notice of Proposed Rulemaking (NPRM), Docket No. 17147, Notice 77-19C.

We will again update the status of this effort when our current NPRM action is completed.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

October 23, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

This is a followup to our letter of May 15, 1979, regarding National Transportation Safety Board Safety Recommendations A-79-1 and A-79-2 issued February 2, 1979. These recommendations stemmed from a Hughes Model 269A helicopter accident at Vancouver, Washington, on May 25, 1978.

We note that Advisory Circular No. 43-16, "General Aviation Airworthiness Alerts" of November 1978, contains an item on the Hughes Model 269A Fuel Boost Pump to satisfy Safety Recommendation A-79-1. This recommendation is therefore classified in a "Closed--Acceptable Action" status.

Safety Recommendation A-79-2 continues to be maintained in an "Open--Acceptable Alternate Action" status for reasons mentioned in our letter. We would appreciate being kept informed of any progress towards its resolution.

Sincerely yours,

James B. King

James B. King
Chairman

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

May 15, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to the Federal Aviation Administration's (FAA) letter of April 27, 1979, responding to National Transportation Safety Board recommendations A-79-1 and A-79-2. These recommendations stemmed from a Hughes Model 269A helicopter accident at Vancouver, Washington, on May 25, 1978. The Safety Board recommended in A-79-1 that the FAA:

> "Issue a General Aviation Airworthiness Alert to all aircraft owners, operators, manufacturers, and maintenance personnel apprising them of the circumstances of this accident and the approved flight manual operating procedures for checking fuel boost pump pressures."

In A-79-2, the Safety Board recommended that the FAA:

> "Advise overhaul facilities and manufacturers that permanent identification of parts is required by 14 CFR 45.15."

The Safety Board is pleased to note that in response to A-79-1, the FAA will issue a General Aviation Airworthiness Alert. Pending such publication, the status of this recommendation is classified as "Open--Acceptable Action." We note that Hughes Helicopters, in response to A-79-2, have agreed to publish a procedure for positive identification of replacement fuel pumps in the Hughes Model 269 Maintenance Manual. We also note that the FAA has a regulatory requirement currently in process which will include the uniform marking of aircraft parts. These actions will satisfy the intent of this recommendation, which is now classified in the "Open--Acceptable Alternate Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

APR 27 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to National Transportation Safety Board Safety Recommendations A-79-1 and A-79-2.

A-79-1. Issue a General Aviation Airworthiness Alert to all aircraft owners, operators, manufacturers, and maintenance personnel apprising them of the circumstances of this accident and the approved flight manual operating procedures for checking fuel boost pump pressures.

Comment. Information concerning the Weldon pump will be included as an alert item in Advisory Circular (AC) 43-16, "General Aviation Airworthiness Alerts." This will appear in the next issue.

A-79-2. Advise overhaul facilities and manufacturers that permanent identification of parts is required by 14 CFR 45.15.

Comment. We have reviewed the recommendation and do not believe that such action is appropriate in this instance.

Federal Aviation Regulations (FAR) 45.15 applies to parts produced under a Parts Manufacturer Approval (PMA). The Weldon Tool Company, manufacturer of the pump, is not a PMA holder but is a supplier to Hughes Helicopters. Hughes Helicopters holds a Federal Aviation Administration Production Certificate (PC) under the provisions of FAR 21.

Parts produced by, or supplied to, a PC holder are marked in accordance with FAA approved quality control procedures and/or as specified in the PC holder's design data. The marking in this instance (Part No. A-8110) by use of a vinyl type name plate and anodized coding is considered satisfactory.

With respect to replacement of parts, the installer is responsible to ensure that they are of an FAA approved origin and approved for the particular application. If such determination cannot be made, as in a case where identification is defaced or removed, the part should not be installed. This is addressed in AC 20-62C, "Eligibility, Quality, and Identification of Approved Aeronautical Replacement Parts." A copy is enclosed.

We recommended to Hughes Helicopters and they have agreed to publish a procedure for positive identification of replacement fuel pumps in the Hughes Model 269A Maintenance Manual.

We have a regulatory project currently in process which will include a requirement for the uniform marking of aircraft parts. This project is scheduled for completion in 1981.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosure

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 2, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-1 and 2

While in cruise flight at an altitude of 800 feet over Vancouver, Washington, on May 25, 1978, a Hughes Model 269A helicopter experienced a loss of engine power. The pilot-in-command took control of the aircraft from a student pilot and implemented autorotation procedures. However, during the descending approach to the intended landing site, the aircraft struck powerlines and fell inverted to the ground. Although there was a large fuel spill, no fire ensued. The student pilot was killed, and the instructor pilot was seriously injured.

The following cockpit information was documented immediately after the accident. Battery and generator switches--on; mixture--rich; carburetor heat--cold; magneto--both; fuel shutoff--on; fuel boost pump--off.

The National Transportation Safety Board's investigation of the accident disclosed that (1) the fuel system for this helicopter requires an auxiliary fuel boost pump that incorporates an internal bypass system; (2) on May 18, 1978, an auxiliary fuel boost pump without a bypass feature had been installed on the aircraft; and (3) the electric fuel boost pump was turned off in flight which caused the engine to lose power because of insufficient fuel flow. The investigation also revealed that only the pump end assembly (Weldon PN A-8110) had been removed on May 18, and it had no identifying decals or the required Weldon name plate attached. The replacement part (Weldon P/N AA-8001-F, S/N 712) appeared to the mechanic who installed it to be identical in size, shape, and appearance to the pump that had been removed. The pump body for the A-8110 fuel pump has a blue anodize finish, while the pump body finish for the AA-8001 is grey.

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The Weldon Tool Company stated that the 8000 Series pump does not include a bypass feature while the 8100 Series pump design does. This valve enables the engine-driven fuel pump to continue to draw fuel through the auxiliary pump even though it is not operating.

These Weldon pumps are identified by a decal which is heat-impressed into the pump body during final assembly. However, during repair or renovation, these decals are frequently defaced or removed, and the only way to distinguish one pump from the other visually is the presence of the bypass valve in the inlet port of the 8100 pump series.

In view of the potentially catastrophic consequences associated with such an installation and to prevent human error in the maintenance of all aircraft that utilize these fuel pumps, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue a General Aviation Airworthiness Alert to all aircraft owners, operators, manufacturers, and maintenance personnel apprising them of the circumstances of this accident and the approved flight manual operating procedures for checking fuel boost pump pressures. (Class II Priority Action) (A-79-1)
>
> Advise overhaul facilities and manufacturers that permanent identification of parts is required by 14 CFR 45.15. (Class II Priority Action) (A-79-2)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, HOGUE, Members, concurred in the above recommendations.

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

APR 22

Honorable J. Lynn Helms
Administrator Designate
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

This is in reference to the Federal Aviation Administration (FAA) letter dated April 1, 1981, responding to National Transportation Safety Board Safety Recommendation A-79-3 issued February 5, 1979. This recommendation stemmed from a Beechcraft Model 35 accident at Redmond, Washington, on August 19, 1978. During the takeoff, the engine lost power and the aircraft stalled and crashed. We recommended that the FAA:

> Issue an Airworthiness Directive to (1) require that a one-time inspection of all Thompson Model 1900 fuel pumps be accomplished to determine the condition of the driver and drive pins (PN TF-1991) and (2) establish an overhaul interval of 800 operating hours on the pump.

We are satisfied with the FAA's analysis. Since we are assured that there have been no recent failures of the Thompson Model 1900 engine-driven fuel pump and since it is the FAA's belief that the guidance provided by the inspection aids and operations handbook is minimizing the probability of fuel pump failures, this recommendation is now classified as "Closed--Reconsidered."

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 1, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-79-3 issued February 5, 1979, and supplements our letter of May 4, 1979. This also responds to your letter of August 15, 1980, in which you requested a progress report.

A-79-3. Issue an Airworthiness Directive to (1) require that a one-time inspection of all Thompson Model 1900 fuel pumps be accomplished to determine the condition of the driver and drive pins (PN TF-1991) and (2) establish an overhaul interval of 800 operating hours on the pump.

FAA Comment. We have again reviewed the records of service difficulties from the Federal Aviation Administration (FAA) Maintenance Analysis Center. Except for the five failures cited in our letter of May 4, 1979, there have been no additional service difficulty reports filed relative to failure of a Thompson Product, Inc., Model 1900 fuel pump.

The FAA published a safety item in the August 1975 issue of General Aviation Inspection Aids Summary (applicable portions enclosed). Moreover, in the Beechcraft Pilots' Operations Handbook and Airplane Flight Manual, dated January 1977 (applicable portion enclosed), an 800-hour overhaul/replacement recommendation was included. This entry, published by Beech Aircraft Corporation, is intended to reduce the probability of failure in the Thompson Model 1900 engine-driven fuel pumps.

We believe these actions fulfill the intent of this recommendation and, accordingly, the FAA considers action completed on Safety Recommendation A-79-3.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosures

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

August 15, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Please refer to your letter of May 4, 1979, and the National Transportation Safety Board's response of June 5, 1979, regarding Safety Recommendation A-79-3 issued February 5, 1979. This recommendation stemmed from a Beechcraft Model 35 accident at Redmond, Washington, on August 19, 1978, and pertained to the Thompson Model 1900 fuel pump.

The Federal Aviation Administration's response indicated that actions would be taken to resolve this recommendation. We requested to be informed when the actions were completed. In order to evaluate the status of this recommendation and bring the public docket up to date, we would appreciate a progress report. Safety Recommendation A-79-3 remains in an "Open--Acceptable Alternate Action" status.

Sincerely yours,

for James B. King
Chairman

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

June 5, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to your letter of May 4, 1979, responding to National Transportation Safety Board recommendation A-79-3. This recommendation stemmed from a Beechcraft Model 35 accident at Redmond, Washington, on August 19, 1978. During the takeoff, the engine lost power and the aircraft stalled and crashed on the airport.

The Safety Board recommended that the Federal Aviation Administration (FAA):

> "Issue an Airworthiness Directive to (1) require that a one-time inspection of all Thompson Model 1900 fuel pumps be accomplished to determine the condition of the driver and drive pins (PN TF-1991) and (2) establish an overhaul interval of 800 operating hours on the pump."

We note that the FAA has reviewed its maintenance records and is of the view that an AD as recommended is not justified. We also note that the FAA intends to publish the item in a General Aviation Aids Summary and include an 800-hour overhaul/replacement recommendation in the Beechcraft Pilot's Operations Handbook. The Safety Board would appreciate being informed when these actions are completed. For the present, this recommendation is being maintained in an "Open--Acceptable Alternate Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 4, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to National Transportation Safety Board (NTSB) Safety Recommendation A-79-3.

A-79-3. Issue an Airworthiness Directive to (1) require that a one-time inspection of all Thompson Model 1900 fuel pumps be accomplished to determine the condition of the driver and drive pins (PN TF-1991) and (2) establish an overhaul interval of 800 operating hours on the pump.

Comment. We have reviewed the records of service difficulties from the Federal Aviation Administration (FAA) Maintenance Analysis Center. This revealed five incidents involving the Thompson Products, Inc., TF-1900 fuel pump. Three of the cases were discovered prior to complete failure during inspections and subsequent to publication of the item in the 1975 FAA General Aviation Inspection Aids Summary.

One pin failed from overload. The pin is designed to fail in shear if excessive binding or other failure of the pump occurs. The remaining pin failure was involved in the accident cited by the NTSB. Inspection of the pump revealed excessive wear and the available records show high time in service.

The evidence available at this time is insufficient to justify mandatory action. We believe that publication of the item in the General Aviation Aids Summary and the inclusion of an 800-hour overhaul/replacement recommendation in the Beechcraft Pilot's Operations Handbook in January 1977 will minimize the probability of failures in these pumps.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 5, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-3

On August 19, 1978, a Beechcraft Model 35, N668D, crashed during the initial climb following takeoff from Redmond, Washington. The engine reportedly lost power, and the aircraft stalled and crashed on airport property. Preliminary investigation revealed that the engine-driven fuel pump, Thompson Products, Inc., Model TF-1900, had failed.

When the pump was disassembled, investigators found that the drive pin had been sheared as a result of excessive wear. Although the engine had been changed 46 hours before the crash, the fuel pump had accumulated 1,501.12 hours since its last overhaul. The fuel pump, originally a Model TF-1100-2, is identified as a Model TF-1900 because the pump rotor, drive pin, and driver had been replaced in accordance with the manufacturer's Service Bulletin 182A, dated May 26, 1955. A second Bulletin, 182B, was issued on October 18, 1955, and stated that it was "imperative to modify" these pumps. Yet a third Bulletin, 182C, was issued on July 18, 1956, to "emphasize the importance of periodic overhaul" and recommended a complete overhaul at 800 hours of service. Airworthiness Directive 55-26-02 was issued to inspect the TF-1100-2 pump every 100 hours until modified to the TF-1900-2. After modification, no further inspection was required nor did the AD apply to the TF-1900 Model. Page 8-41 of the Beechcraft Pilot's Operating Handbook, an approved FAA Flight Manual issued January 1977, states that the recommended overhaul or replacement interval for the TF-1900-2 engine driven fuel pump is 800 hours.

The fuel pump involved in the accident had accrued its time on two different engines. The first engine was operated 1,455.1 hours before overhaul. The fuel pump was then installed on the newly overhauled engine without any tests or overhaul.

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A review of Maintenance Difficulty reports of the FAA over the past five years disclosed that eight TF-1900 fuel pumps have failed. Page 99 of the 1975 edition of the General Aviation Inspection Aids Summary documents two fuel pump drive pin failures which have caused power losses.

Therefore, the Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive to (1) require that a one-time inspection of all Thompson Model 1900 fuel pumps be accomplished to determine the condition of the driver and drive pins (PN TF-1991) and (2) establish an overhaul interval of 800 operating hours on the pump. (Class I--Urgent Action) (A-79-3)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and HOGUE, Members, concurred in the above recommendation.

By: James B. King
Chairman

US Department
of Transportation

**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

June 16, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-79-4 and A-79-5 issued March 8, 1979, and supplements our letter of May 15, 1979. This also responds to your letter of February 25, 1981, in which you requested an updated status report.

A-79-4. Issue an Advisory Circular or take other appropriate action to alert pilots to the fact that unwanted and unknown continued engine starter operation may result in complete electrical failure in general aviation airplanes in service. Also, describe actions pilots can take to avoid such engine-starter operation.

FAA Comment. As stated in our letter of May 15, 1979, the Federal Aviation Administration (FAA) planned to issue an advisory circular (AC). On October 28, 1980, we issued AC 91-55 entitled, "Reduction of Electrical System Failures Following Aircraft Engine Starting." This AC is designed to warn general aviation aircraft owners, pilots, and maintenance personnel of possible total electrical system failure following aircraft engine starting. A copy of this AC is enclosed. The FAA considers action completed on Safety Recommendation A-79-4.

A-79-5. Amend 14 CFR 23 and 14 CFR 27 to require indication by which a pilot can be advised whenever an electric engine starter is operating.

FAA Comment. FAR 23.1309, as adopted in November 1973 and amended in December 1976, and FAR 27.1309, as recodified in 1964 from CAR 6.606 as adopted in September 1959, provide general safety standards that require all equipment, systems, and installations be designed to prevent hazards to aircraft in the event of malfunction or failure. One means to prevent such hazards from a malfunctioning starter system would be to install an indicator that alerts the pilot to the malfunction. Another means would be to use a starter that could be operated continuously, or to provide a system that is otherwise designed to prevent a hazard should it fail.

Therefore, on the basis of our study referenced in our letter of May 15, 1979, we find that the current regulations for normal category airplanes (FAR 23) and helicopters (FAR 27) are adequate, and we plan no regulatory amendments. Also, we do not anticipate further airworthiness directive action on this matter; AC 91-55 provides equivalent guidance for existing aircraft.

Our regional aircraft certification staffs have been provided copies of your recommendation. Copies of this response will also be provided to the staffs to insure continued application of FAR 23.1309 and 27.1309 accordingly. The FAA considers action complete on Safety Recommendation A-79-5.

Sincerely,

J. Lynn Helms
Administrator

Enclosure

Office of the Chairman

National Transportation Safety Board

Washington, D.C. 20594

February 25, 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Please refer to National Transportation Safety Board Safety Recommendations A-79-4 and 5 issued March 8, 1979. The Federal Aviation Administration's response of May 15, 1979, indicated that actions were underway to resolve these recommendations. In our reply of June 8, 1979, we informed the FAA that these recommendations were being held in an "Open--Acceptable Action" status. In order to evaluate their progress and update the public docket, we would appreciate an updated status report.

Sincerely yours,

James B. King

James B. King
Chairman

Office of the
Chairman

National Transportation Safety Board

Washington D.C. 20594

June 8, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of May 15, 1979, responding to National Transportation Safety Board recommendations A-79-4 and A-79-5. These recommendations emanated from a Safety Board investigation of a Beechcraft, Model 65, accident at Norfolk, Virginia, on March 4, 1978. The airplane's electrical system failed after takeoff. Investigation revealed that the starter relay failed causing the starter motor to continuously energize. The result was complete loss of electrical power. Investigation also revealed that this electrical system failure had occurred in other makes and models of general aviation aircraft. In order to prevent operational hazards associated with the loss of electrical power, the Safety Board recommended that the Federal Aviation Administration (FAA):

A-79-4 Issue an Advisory Circular or take other appropriate action to alert pilots to the fact that unwanted and unknown continued engine starter operation may result in complete electrical failure in general aviation airplanes in service. Also, describe actions pilots can take to avoid such engine-starter operation.

A-79-5 Amend 14 CFR 23 and 14 CFR 27 to require indication by which a pilot can be advised whenever an electric engine starter is operating.

We note that the FAA has issued an Airworthiness Directive with regard to this same problem as it applies to the Beech Model 76. We also note that the FAA has undertaken a study of this problem as it applies to the Beech Model 65 and other aircraft. The FAA's response

indicates that, based on this study, an Advisory Circular will be developed by September 1, 1979, to make pilot and maintenance personnel aware of the problem and provide measures for dealing with it. The response also indicates that necessary regulatory action will be initiated by December 1, 1979.

We appreciate receiving FAA's response and are of the view that actions taken as a result of the FAA study will fulfill the intent of A-79-4 and 5. For the present, these recommendations are being maintained in an "Open--Acceptable Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

May 15, 1979

OFFICE OF
THE ADMINISTRATOR

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to National Transportation Safety Board Safety Recommendations A-79-4 and 5.

A-79-4. Issue an Advisory Circular or take other appropriate action to alert pilots to the fact that unwanted and unknown continued engine starter operation may result in complete electrical failure in general aviation airplanes in service. Also, describe actions pilots can take to avoid such engine-starter operation.

Comment. We are developing an advisory circular (AC) which will provide pilot and maintenance personnel with awareness of the problem and measures for dealing with it. Because of the several types of aircraft which have experienced this problem, we are conducting a study to assure inclusive applicability of the AC. We expect to complete the study and issue the AC by September 1.

A-79-5. Amend 14 CFR 23 and 14 CFR 27 to require indication by which a pilot can be advised whenever an electric engine starter is operating.

Comment. A recent engine starter relay failure and subsequent loss of all electrical power occurred on a Beech Model 76. An airworthiness directive project has been initiated which will propose a flight manual revision which contains procedures for preflight inspection to detect a malfunctioning engine starter relay and an inflight procedure for restoration of electric power should power loss occur.

In addition, we are studying the problem as it relates to other makes and models. We expect to complete the study by September 30, any action with respect to all relays by December 31, and to initiate any regulatory action considered necessary by December 31. We will advise you of any actions which are undertaken.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 8, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-4 and -5

The National Transportation Safety Board is concerned about general aviation engine-starter system failures that sometimes result in complete failure of the airplane's electrical system.

A Beechcraft Queen Air, Model 65, N342N, operating under 14 CFR 135, had a complete electrical failure shortly after takeoff at Norfolk, Virginia, on March 4, 1978. The pilot proceeded to manually extend the landing gear and apparently decided it was down and locked. However, the gear collapsed during the landing roll, and the airplane was substantially damaged. Although the accident can be attributed to failure to follow the checklist for emergency extension of the landing gear, the total electrical failure must be considered the underlying cause. Postaccident examination of the right engine-starter system revealed that the starter case was badly blistered, the starter relay terminal boots were severely damaged by heat, the relay plunger was in the on position, and the relay fixed contact point was fused to the movable contact point. The Safety Board concludes that continued operation of the starter motor had overheated and overloaded the electrical system, causing the complete failure.

A survey of similar experience in the FAA's Service Difficulty Records, covering General Aviation Starter Systems for a 1-year period through August 9, 1978, indicated that there had been at least 26 instances of contactor, often called "relay" or "solenoid," failures. Most, if not all, of these involved uninitiated or continued starter operation. In most cases the fault was noted when the engine rotated with only the master switch activated. However, in six cases, one including another Beechcraft Queen Air, continued starter motor operation apparently was not detected and the electrical system failed completely. At least two of the six cases, both involving Beechcraft B24R's, occurred during IFR flight when loss of the electrical system can be most serious. Other models involved were a Beechcraft A36, a Beechcraft C23, and a Piper PA-31-350.

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Among the 20 cases in which the fault apparently was detected and did not result in complete electrical failure, 14 involved Cessnas; most of the 14 were model 210's. The other six involved a Mooney 20F and five Beechcraft models--a Queen Air 65-B80, two B19's, a C24R, and an A36.

Although the records do indicate that some airplanes are more prone than others to develop this kind of fault, the Safety Board believes that the hazard potential is sufficiently universal as to call for industrywide attention.

The Safety Board believes that aircraft owners and pilots should be warned of the possibility of encountering electrical system failure as a result of the unintentional or continued operation of starter motors, and should be provided guidance regarding means of reducing the risk of such failures. Such means could include modification of existing aircraft electrical systems to require contactor redundancy or periodic inspection or replacement of certain electrical components. For future production aircraft, the Safety Board believes that some positive means should be provided to indicate to the pilot that an engine starter is operating.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an Advisory Circular or take other appropriate action to alert pilots to the fact that unwanted and unknown continued engine starter operation may result in complete electrical failure in general aviation airplanes in service. Also, describe actions pilots can take to avoid such engine-starter operation. (Class II--Priority Action) (A-79-4)
>
> Amend 14 CFR 23 and 14 CFR 27 to require indication by which a pilot can be advised whenever an electric engine starter is operating. (Class III--Longer Term Action) (A-79-5)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, and HOGUE, Members, concurred in the above recommendations.

By: James B. King
Chairman

U.S. Department of Transportation
Federal Aviation Administration

Office of the Administrator

800 Independence Ave. S.W.
Washington, D.C. 2059'

June 15, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-79-7 and A-79-8 issued March 12, 1979, and supplements our letter of June 7, 1979. This also responds to your letter of April 17, 1981, in which you requested further response to these recommendations and information regarding the results of the Federal Aviation Administration's (FAA) Maintenance Analysis Center review.

A-79-7. Issue an Airworthiness Directive to require the immediate inspection of all Piper aircraft equipped with control stop bolt installations where extension of the stop bolt can limit control surface travel to determine if stop bolt position or jam nut torque has changed. Require readjustment of the stop bolt and retorquing of the jam nut as necessary. Require that the stop bolt installation be modified to include safety wire or some other positive nonfriction means of preventing rotation of the stop bolt during the application of vibratory loads.

FAA Comment. As correctly stated in your letter of April 17, 1981, Piper Aircraft Corporation has incorporated a production change in the PA-31 series that provides for positive locking of the stop bolt and lock nut by safety wiring the bolt and nut to airplane structure. Piper is also preparing a service bulletin recommending safety wire installation on airplanes in the field. The FAA will evaluate the service bulletin when issued to determine what further action might be appropriate. We will advise the Board of our evaluation and provide a copy of the service bulletin when issued.

A-79-8. Issue a Maintenance Bulletin to alert general aviation inspectors of the possibility of loosened or misadjusted control stop bolts on general aviation aircraft. Stops on various models of aircraft should be spot checked to ensure that control stop bolts are positively secured and that there is no possibility that vibratory loads can result in a change in the range of travel of any control surface.

FAA Comment. As previously stated, the FAA has issued three Airworthiness Alert Bulletins on this subject (copies enclosed). We believe this action satisfies the intent of Safety Recommendation A-79-8, and we consider action on this recommendation completed.

Sincerely,

J. Lynn Helms
Administrator

Enclosures

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

April 17, 1981

Honorable J. Lynn Helms
Administrator Designate
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Reference is made to National Transportation Safety Board Safety Recommendations A-79-7 and -8 issued March 12, 1979. These recommendations stemmed from a PA-31 Navajo Chieftain takeoff accident at Las Vegas, Nevada, on August 30, 1978. Investigation revealed that an elevator stop bolt backed out of position obstructing elevator movement, and making it impossible for the pilot to prevent a pitchup and stall after takeoff.

The Federal Aviation Administration (FAA) response of June 7, 1979, indicated several actions taken and ongoing to resolve these recommendations. In our followup letter of July 3, 1979, we stated that we were keeping these recommendations in an "Open--Acceptable Action" status pending the completion of the FAA's actions. We have not yet received a response to this letter. We are aware that the FAA issued Piper Airworthiness Directive (AD) 79-12-02, Amendment 39-3484, which was further amended by Amendment 39-3501. We are also aware that the Piper Aircraft Corporation will modify the stop bolt installations on all models beginning with the 1981 model. This modification will call for drilled bolt heads, safety wire, and drilled nuts. The safety wire will extend from the drilled bolt head through the drilled nut to the forged arm of the down-stop hinge.

However, we are now investigating a similar type accident. A Piper PA-31 Navajo Chieftain crashed on takeoff at Prescott, Arizona, on February 10, 1981. After the gear was retracted, the nose pitched up and a stall occurred. Prior to the pilot reducing power, he and the right front passenger vainly tried to push the yoke forward to recover from the stall. Investigation revealed that the elevator down-stop bolt, that limits the down elevator travel, had backed out eight threads. The requirements of the AD had been complied with on May 10, 1979.

This recent accident has added to our concern in that a positive locking method is not utilized to prevent such occurrences. We request a further response to our two recommendations and to be informed of the results of the FAA's Maintenance Analysis Center review.

Sincerely yours,

James B. King

515 James B. King
Chairman

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

July 3, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of June 7, 1979, responding to recommendations A-79-7 and 8. These recommendations stemmed from the Las Vegas Airlines PA-31 Navajo Chieftain accident at Las Vegas, Nevada, on August 30, 1978. The National Transportation Safety Board's investigation revealed that a backed-out elevator down-stop bolt obstructed elevator movement, making it impossible for the pilot to prevent a pitchup and stall after takeoff. Post-accident inspections showed backed-out bolts in three other PA-31's and in four other airplanes.

Recommendation A-79-7 called upon the Federal Aviation Administration (FAA) to issue an Airworthiness Directive (AD) requiring immediate inspections of all Piper aircraft equipped with similar control stop bolts, and modifications of such installations with either safety wiring or another positive nonfriction means to prevent stop bolt rotation under vibration. We note that the FAA is in the process of issuing an AD for the PA-31. We also note that the FAA is reviewing the problem to determine whether all aircraft equipped with the stop bolt/lock nuts should be inspected. Pending the FAA's conclusive action, A-79-7 is being maintained in an "Open--Acceptable Action" status.

In A-79-8, we recommended that the FAA issue a maintenance bulletin to alert general aviation inspectors to the possibility of loosened or maladjusted control stop bolts and suggested spot-checking of bolts for proper security. We are pleased to learn that the FAA has issued a General Aviation Airworthiness Alert (Advisory Circular No. 43-16, Alert No. 11 dated June 1979), recommending periodical checks of the control surface travel and the condition of control surface stops. We also note that the FAA intends to issue a maintenance bulletin. Pending completion of this action, this recommendation is also being maintained in an "Open--Acceptable Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

June 7, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to National Transportation Safety Board Safety Recommendations A-79-7 and 8.

A-79-7. Issue an Airworthiness Directive to require the immediate inspection of all Piper aircraft equipped with control stop bolt installations where extension of the stop bolt can limit control surface travel to determine if stop bolt position or jam nut torque has changed. Require readjustment of the stop bolt and retorquing of the jam nut as necessary. Require that the stop bolt installation be modified to include safety wire or some other positive nonfriction means of preventing rotation of the stop bolt during the application of vibratory loads.

Comment. A telephonic Directed Safety Investigation (DSI) to inspect elevator stop bolts and elevator surface travel on PA-31 airplanes resulted in one report of a loose bolt. As a result of this finding an airworthiness directive (AD) is being prepared. This AD will require a check of elevator travel, inspection of the condition of the stop bolts, and retorque of the stop bolt/lock nuts. We expect this AD to be issued within the next 30 days.

At this time, we do not have sufficient evidence of unsatisfactory performance to justify a regulatory requirement to modify or redesign stop bolt/lock nut control surface stops on other makes and models of aircraft. We are conducting a review of service experience at the Federal Aviation Administration Maintenance Analysis Center. If a problem is indicated, a DSI to inspect all aircraft equipped with stop bolt/lock nuts will be accomplished. If any deficiencies are found, AD's will be considered. We expect to complete the Maintenance Analysis Center review by July 15, 1979. Completion schedule for any further actions will be established at that time.

A-79-8. Issue a Maintenance Bulletin to alert general aviation inspectors of the possibility of loosened or misadjusted control stop bolts on general aviation aircraft. Stops on various models of aircraft should be spot checked to ensure that control stop bolts are positively secured and that there is no possibility that vibratory loads can result in a change in the range of travel of any control surface.

Comment. We will issue a maintenance bulletin in June 1979 which will alert field inspectors to the possibility of loose or misadjusted flight control stop bolts on aircraft which fall within their responsibilities.

An Airworthiness Alert, Advisory Circular Number 43-16, advising owners, operators, and mechanics to check control surface travel and the condition of control surface stops has been prepared for the June 1979 issue.

We believe that the actions described above comply with the intent of the recommendations.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 12, 1979

Forwarded to:
Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-7 and 8

On August 30, 1978, a Piper Model 31-350 aircraft, N44LV, crashed shortly after takeoff from Las Vegas, Nevada; the 10 persons on board were killed. Witnesses saw the aircraft reach a steep nose-high attitude after takeoff before it fell off on the right wing, reversed direction, and dove toward the ground. The aircraft had achieved a nearly flat attitude in an apparent attempt to recover when it struck the ground with high vertical forces.

An inspection of the aircraft's flight control system disclosed that an elevator surface control stop bolt had become loosened and was extended to a position where it restricted the travel of the elevator surface in the trailing-edge-down direction. The control stop consists of a bolt threaded into the aluminum casting which contains the elevator hinge bearing. The stop is effected as the elevator torque arm assembly bottoms against the head of this bolt. The up-stop bolt and the down-stop bolts are adjusted during installation or subsequent rigging of the control system to provide the specified rotational range of elevator travel. The bolts are then locked into place by applying torque to a jam nut against the hinge bearing housing assembly. The postaccident examination disclosed that the down-stop bolt was extended about 1/2 inch from its "as installed" position before it sustained impact damage. This extension would have restricted the elevator travel to less than half of its normal range. The trailing-edge-down travel would have been 1° to 2° below the neutral or faired position.

Flight tests conducted after the accident showed that an aircraft with the same load and center of gravity location as N44LV would pitch up at an increasing rate after takeoff if the elevator was held in a neutral position. Trailing edge down elevator was required to recover from this maneuver.

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AD-A105 702 FEDERAL AVIATION ADMINISTRATION WASHINGTON DC OFFICE--ETC F/G 1/2
SUMMARY OF FEDERAL AVIATION ADMINISTRATION RESPONSES TO NATIONA--ETC(U)
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6 of 8

Two other instances of elevator control stops which were not in their proper position were discovered during a fleet inspection by the Las Vegas Airlines after the accident. Another instance of a control stop loosening during flight was reported to the FAA by an Oklahoma operator of a PA-31-350.

The PA-31-350 was certificated under Part 3 of the Civil Air Regulations. Paragraph 3.340 specifies that control stops must be located so that slack, wear, or takeup adjustment will not affect the range of surface travel. The possibility that an extension of the PA-31's surface control stops could result from improper torque of the jam nut or application of vibratory loads is not covered by the regulation.

Current requirements for certification of new aircraft, as specified in Part 23 of the Federal Aviation Regulations, are essentially the same as those of CAR 3 with regard to control stops. However, paragraph 23.607, which concerns the use of self-locking nuts, might be considered applicable to control stops. This paragraph specifies the use of a nonfriction locking device on any bolt which is subject to rotation in operation. This would imply that the elevator control stop bolts on the PA-31 aircraft would have to be locked in position by some positive means other than a jam nut. The Safety Board is aware that the stops on other control surfaces on the PA-31 aircraft and the stops on control surfaces of other model Piper aircraft are of similar design.

Since the potential is great for a catastrophic accident, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive to require the immediate inspection of all Piper aircraft equipped with control stop bolt installations where extension of the stop bolt can limit control surface travel to determine if stop bolt position or jam nut torque has changed. Require readjustment of the stop bolt and retorquing of the jam nut as necessary. Require that the stop bolt installation be modified to include safety wire or some other positive nonfriction means of preventing rotation of the stop bolt during the application of vibratory loads. (Class I--Urgent Action) (A-79-7)

> Issue a Maintenance Bulletin to alert general aviation inspectors of the possibility of loosened or misadjusted control stop bolts on general aviation aircraft. Stops on various

models of aircraft should be spot checked to ensure that control stop bolts are positively secured and that there is no possibility that vibratory loads can result in a change in the range of travel of any control surface. (Class I--Urgent Action) (A-79-8)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and HOGUE, Members, concurred in the above recommendations.

By: James B. King
Chairman

US Department of Transportation

Federal Aviation Administration

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

May 26, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-79-27 through A-79-30 issued May 1, 1979, and supplements our letter of July 27, 1979. This also responds to your letter of February 25, 1981, in which you requested a further report of actions taken.

A-79-27. Amend 14 CFR 37.201 to: (1) require that ground proximity warning systems identify with aural messages the cause of the warning being given; and (2) restrict the function of the deactivation switch (if utilized on such systems) to suppress only the aural alert, but not the warning lights.

A-79-28. Amend 14 CFR 121.360 to require after an appropriate date that all newly manufactured aircraft be equipped with ground proximity warning systems that conform to the amended Technical Standard Order.

FAA Comment. As noted in our previous correspondence to the Board, the FAA is conducting research on these subject areas under Contract DOT-FA-79-WA-4268. This research has yet to provide sufficient justification to support rulemaking as recommended by the Board. Until data is available to prove otherwise, our analysis leads us to conclude that the present rules provide an adequate level of safety when proper procedures are followed.

A-79-29. Define sound pressure levels and acoustical characteristics for ground proximity warning systems for each type of aircraft requiring these systems, consistent with ambient cockpit noise levels and with the requirements for emergency verbal communications between crewmembers.

FAA Comment. Report Number FAA-RD-76-22, "Aircraft Alerting Systems Criteria Study," the third in a series of Independent Altitude Monitoring Study contracts, involved a study of cockpit alerting system problems, the

proliferation of alerting devices in the cockpit, nonadherence to existing alerting systems standards because they are outdated, and the need for a set of design objectives and design guidelines acceptable to all commercial transport aircraft operators and manufacturers.

The human factors portion of this study suggests an automatic intensity adjustment for various ambient noise conditions. It also states that, because cockpit ambient noise level varies with the operational phase of the same model, automatic intensity adjustment is the only way that the signal of an alerting system can be as loud as the masked threshold created by ambient noise plus 10dB or halfway between the masked threshold and 110dB. We anticipate that an FAA contract for an "Aircraft Alerting System Standardization Study" (DOT-FA79WA-4268) will define sound pressure levels for alerting systems consistent with ambient cockpit noise levels and considering requirements for emergency verbal communications between crewmembers. When the results of this study are available, the FAA will determine what, if any, action is needed.

A-79-30. Issue an Advisory Circular specifying ground proximity warning system sound pressure levels and acoustical characteristics for each type of aircraft requiring these systems.

FAA Comment. When the results of Contract Number DOT-FA79WA-4268, mentioned in our response to Recommendation A-79-29, become available, we will consider the issuance of guidance material. The FAA will keep the Board informed of significant progress as our efforts continue in this area.

Sincerely,

J. Lynn Helms
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

FEB 25 [illegible]

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Please refer to the Federal Aviation Administration's (FAA) letter of July 27, 1979, and the National Transportation Safety Board's reply of August 30, 1979, regarding Safety Recommendations A-79-27 through -30. These recommendations pertain to the Ground Proximity Warning System.

The FAA's letter indicated that actions were in progress toward resolution of these recommendations. In order to evaluate their progress and update the public docket, we would appreciate a further report of actions taken.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

July 27, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to National Transportation Safety Board Safety Recommendations A-79-27 through 30.

A-79-27. Amend 14 CFR 37.201 to: (1) require that ground proximity warning systems identify with aural messages the cause of the warning being given; and (2) restrict the function of the deactivation switch (if utilized on such systems) to suppress only the aural alert, but not the warning lights.

A-79-28. Amend 14 CFR 121.360 to require after an appropriate date that all newly manufactured aircraft be equipped with ground proximity warning systems that conform to the amended Technical Standard Order.

Comment. We do not believe that available data is sufficient to support rulemaking at this time. The present rules, which permit manufacturers of ground proximity warning systems (GPWS) innovation in verbal messages, provide an adequate level of safety.

We are, however, seeking methods for improving the flight deck working environment and have contracted for an "Aircraft Alerting System Standardization Study," (DOT FA-79-WA-4268, 9 January 1979 - 9 December 1980). This study includes items involving GPWS criteria such as visual alert displays and aural warning sound levels. The first study report due in September 1979 is concerned with a definition of prototype alerting system concepts. If the study produces significant improvements in aircraft alerting systems, we will consider rulemaking action.

The Federal Aviation Administration approved Boeing 727 Airplane Flight Manual (AFM) includes proper crew response to alerts and deactivation conditions in accordance with 14 CFR 121.360(c) and (d). Since the system may be deactivated only to prevent nuisance warnings when landing with flaps or landing gear not in the normal landing positions, we believe that 14 CFR 37.201 requiring aural and visual warnings to activate simultaneously is adequate. A copy of the GPWS section of the B-727 AFM is enclosed.

A-79-29. Define sound pressure levels and acoustical characteristics for ground proximity warning systems for each type of aircraft requiring these systems, consistent with ambient cockpit noise levels and with the requirements for emergency verbal communications between crewmembers.

Comment. Report Number FAA-RD-76-222, "Aircraft Alerting Systems Criteria Study," contains a recommendation to provide automatic intensity adjustment for varying ambient noise conditions. It also states that because cockpit ambient noise level varies with the operational phase of the same model, automatic intensity adjustment is the only way that the signal of an alerting system can be as loud as the masked threshold created by ambient noise plus 10dB or halfway between the masked threshold and 110dB. We anticipate that Contract Number DOT-FA-WA-4268 will define sound pressure levels for alerting systems consistent with ambient cockpit noise levels and considering requirements for emergency verbal communications between crewmembers.

A-79-30. Issue an Advisory Circular specifying ground proximity warning system sound pressure levels and acoustical characteristics for each type of aircraft requiring these systems.

Comment. When the results of Contract Number DOT FA-79-WA-4268 become available, we will consider the issuance of guidance material.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosure

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 1, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

SAFETY RECOMMENDATION(S)

A-79-27 through -30

On May 8, 1978, National Airlines Flight 193, a Boeing 727-235, crashed in Escambia Bay during its approach to the Pensacola Regional Airport at Pensacola, Florida. There were 52 passengers and a crew of 6 aboard; 3 passengers were drowned, and 9 passengers and 2 crewmembers were seriously injured.

As the aircraft descended through 500 feet altitude, its rate of descent had increased to about 2,000 feet per minute; the aircraft was also not configured for landing -- the flaps were set at 25°. At this point, the ground proximity warning system (GPWS) activated and continued for five cycles, or about 9 seconds.

The captain and first officer tried to determine the cause of the GPWS warning. The cockpit voice recorder tape indicated that the first officer said, "Descent rate's keepin' it up." The captain reportedly acknowledged this and shallowed the aircraft's descent. The flight engineer, who claimed to have had difficulty hearing the cockpit conversation because of the volume of the GPWS aural alert, believed that the captain had commanded him to turn off the GPWS. As a result, he inhibited the system without the captain's knowledge. The silencing of the GPWS erroneously convinced the captain that he had solved the problem; however, the aircraft continued to descend into the water.

The GPWS in this aircraft incorporated warning lights mounted on both instrument panels and a loudspeaker mounted in the ceiling of the cockpit. A guarded and safety-wired inhibit switch was located on the flight engineer's panel. The GPWS will activate automatically if the aircraft's flightpath penetrates one or more complex, multiparameter flight envelopes. The aural and visual warning will cease only when the aircraft's flightpath is corrected satisfactorily or when the aircraft is configured properly depending on the warning conditions. However, the inhibit switch, when activated, will disable the entire system. The Safety Board believes that, regardless of the safeguards

established by the applicable regulations to prevent inadvertent or voluntary deactivation of the system, the function of the inhibit switch should not cause an apparent but false problem-solving situation as it did in this accident.

The GPWS in this aircraft was only required to provide two messages --"pull up" and "glideslope." Thus, during this approach, the crew was required to determine mentally whether an excessive terrain closure rate or a nonlanding configuration caused the warning before they could take corrective action. Obviously, there was some uncertainty as to the cause of the warning; the crew decided that it was an excessive descent rate below 2,500 feet when, in fact, a nonlanding configuration below 500 feet was also triggering the warning.

As you know, 14 CFR 37.201 (TSO-C92a) and Radio Technical Commission for Aeronautics Document No. DO-161A, "Minimum Performance Standards, Airborne Ground Proximity Warning System," do not require that the cause of an alert be identified. The technology exists, however, to provide individual warnings to the crew for each deviation. At least one manufacturer now offers a GPWS with features which specifically announce the reason for each triggered warning, such as "sink rate," "terrain," or "flaps." The Board believes that these features will eliminate ambiguity and will reduce considerably crew reaction time to the warning being given.

The crewmembers reported also that the sound of the GPWS was so loud and uncomfortable that it interfered with cockpit communication. At the Board's request, an FAA Civil Aeromedical Institute acoustics specialist measured the sound level of the GPWS in a National Airlines Boeing 727 aircraft, in a National simulator, and in an Eastern Airlines Boeing 727. Sound levels were above 103 decibel (dB) in the National simulator and in the National aircraft. These were generally several dB higher than in the Eastern aircraft.

The standards for GPWS output signals are specified electrically by Radio Technical Commission for Aeronautics Document No. DO-161A; however, because of variations in loudspeaker efficiency, baffling, and location, the level of the acoustical signals can vary widely in different areas of the cockpit. Informal information from the FAA, air carriers, and GPWS manufacturers indicates that currently acoustics levels are set subjectively by air carrier engineering personnel and are approved by FAA Principal Operations Inspectors usually without using sound level measuring instruments. The Safety Board is concerned that, by using this subjective method, the sound pressure levels for these warning systems can be set too high, thereby masking emergency

communications between the crewmembers. In this accident, verbal communications evidently were blocked by the high sound levels of the GPWS.

A 1977 study "Aircraft Alerting Systems Criteria Study," Report No. FAA-RD-76-222 recommended that the signal of an alerting system should be as loud as the masked threshold created by ambient noise plus 15 dB or should be halfway between the masking threshold and 110 dB, whichever is less. This study shows cockpit noise data for eight turbojet air carrier aircraft and presents a simple method for calculating the threshold values of alerting systems. The Safety Board believes that the FAA should require some form of standardization of GPWS aural warnings in different aircraft using the data presented in this report. This FAA guidance will permit engineering personnel to set sound levels objectively and will result in optimum signal strength in cockpits without unduly affecting necessary verbal communications between crewmembers.

In view of the above, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend 14 CFR 37.201 to: (1) require that ground proximity warning systems identify with aural messages the cause of the warning being given; and (2) restrict the function of the deactivation switch (if utilized on such systems) to suppress only the aural alert, but not the warning lights. (Class II - Priority Action) (A-79-27)
>
> Amend 14 CFR 121.360 to require after an appropriate date that all newly manufactured aircraft be equipped with ground proximity warning systems that conform to the amended Technical Standard Order. (Class II - Priority Action) (A-79-28)
>
> Define sound pressure levels and acoustical characteristics for ground proximity warning systems for each type of aircraft requiring these systems, consistent with ambient cockpit noise levels and with the requirements for emergency verbal communications between crewmembers. (Class II - Priority Action) (A-79-29)

Issue an Advisory Circular specifying ground proximity warning system sound pressure levels and acoustical characteristics for each type of aircraft requiring these systems. (Class II - Priority Action) (A-79-30)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and HOGUE, Members, concurred in the above recommendations.

By James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

May 18, 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

This is to acknowledge the Federal Aviation Administration's (FAA) letter dated April 1, 1981, responding to National Transportation Safety Board Safety Recommendations A-79-33 and -34 issued May 11, 1979. These are two of three recommendations that stemmed from our investigation of a United Airlines DC-8 accident near Portland, Oregon, on December 28, 1978. Companion Recommendation A-79-32 was earlier classified "Closed--Acceptable Action."

In Safety Recommendation A-79-33 we recommended that the FAA:

> Emphasize to engineering personnel who approve aircraft engineering changes or issuance of Supplemental Type Certificates the need to consider cockpit configuration and instrumentation factors which can contribute to pilot confusion, such as the use of similar-appearing instruments with different scale factors.

We are pleased that the FAA's Western Region Aircraft Engineering Division issued a letter dated September 9, 1980, to emphasize to engineering personnel who evaluate crew station design the need to consider cockpit configuration and instrument factors that contribute to pilot confusion. We are also pleased to note that the FAA is issuing an advisory circular to enhance public awareness on this subject. Safety Recommendation A-79-33 is now classified in a "Closed--Acceptable Action" status.

In Safety Recommendation A-79-34 we asked the FAA to:

> Audit Supplemental Type Certificate SA3357WE-D for completeness, especially in the area of system calibration after installation.

We note that an audit was completed on May 29, 1980, and that no unsafe condition was found on this or any other Supplemental Type Certificate issued by United Air Lines under Designated Authorization Station 1-WE. We also note that data deficiencies on STC SA3357WE-D have been resolved. This recommendation is also classified in a "Closed--Acceptable Action" status.

We thank the FAA for actions taken toward fulfilling these recommendations.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

April 1, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-79-32 through 34 issued May 11, 1979, and supplements our letter of July 23, 1979. This also responds to your letter of August 15, 1980, in which you requested an updated status report.

Safety Recommendation A-79-32 has been classified in a "Closed--Acceptable Action" status. Accordingly, this response addresses Safety Recommendations A-79-33 and 34.

A-79-33. Emphasize to engineering personnel who approve aircraft engineering changes or issuance of Supplemental Type Certificates the need to consider cockpit configuration and instrumentation factors which can contribute to pilot confusion, such as the use of similar-appearing instruments with different scale factors.

FAA Comment. The Federal Aviation Administration's (FAA) Western Region Aircraft Engineering Division has issued a letter dated September 9, 1980, titled, "Findings of Compliance Involving Crew Station Design" (copy enclosed). This letter has been distributed to all Western Region engineering personnel involved in crew station design approvals. The document reemphasizes the need to consider cockpit configuration and instrumentation factors when approving engineering changes or issuing supplemental type certificates (STC's).

On the basis of this letter, we are issuing an advisory circular for national application in order to enhance public awareness, particularly to those having responsibility for design.

A-79-34. Audit Supplemental Type Certificate SA3357WE-D for completeness, especially in the area of system calibration after installation.

<u>FAA Comment</u>. In response to A-79-34, the subject audit was completed on May 29, 1980, by FAA Western Region personnel. As suggested in the recommendation, particular attention was paid to ". . . completeness, especially in the area of system calibration after installation." No unsafe condition was determined to exist on this or any other STC issued by United Air Lines under Designated Authorization Station 1-WE. The data deficiencies on STC SA3357WE-D have been resolved and a satisfactory calibration report is available. The FAA is satisfied that the DC-8 fuel quantity indicating system modification for STC SA3357WE-D is safe and in accordance with applicable regulations.

We believe these actions satisfy the intent of Safety Recommendations A-79-33 and A-79-34. Accordingly, the FAA considers action completed on these recommendations.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

Office of
Chairman

**National Transportation
Safety Board**

Washington, D.C. 20594

August 15, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to National Transportation Safety Board Safety Recommendations A-79-32 through 34 issued May 11, 1979. These recommendations stemmed from our investigation of a United Airlines DC-8 accident near Portland, Oregon, on December 28, 1978.

By letter dated March 13, 1980, we informed the Federal Aviation Administration (FAA) that A-79-32 had been classified in a "Closed--Acceptable Action" status. However, A-79-33 and A-79-34 remain in an "Open--Acceptable Action" status awaiting the FAA's further response. In order to evaluate the progress of these recommendations and update the public docket, we would appreciate an updated status report.

Sincerely yours,

for James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

March 13, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to your letter dated July 23, 1979, responding to the National Transportation Safety Board's recommendation A-79-32. The recommendation stemmed from the Safety Board's investigation of a United Airlines DC-8 accident near Portland, Oregon, on December 28, 1978. We recommended that the Federal Aviation Administration (FAA) issue an Operations Alert Bulletin to have FAA inspectors assure that crew training stresses differences in fuel-quantity measuring instruments and that crews flying with the new system are made aware of the possibility of misinterpretation of gage readings.

Your letter indicated that the FAA planned to issue an air carrier operations bulletin to comply with the above recommendation. We note that the FAA has since issued "Air Carrier Operations Bulletin No. 8-79-2 Possible Misinterpretation of Fuel Gage Readings." (No. 8430.17 CHG 11 dated November 3, 1979). This action satisfies the intent of A-79-32 which is now classified in a "CLOSED—ACCEPTABLE ACTION" status.

Sincerely yours,

James B. King

James B. King
Chairman

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

August 27, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of July 23, 1979, responding to the National Transportation Safety Board's recommendations A-79-32 through A-79-34. The recommendations stemmed from the Safety Board's investigation of a United Airlines DC-8 accident near Portland, Oregon, on December 28, 1978. The investigation revealed that all four engines stopped because of fuel exhaustion as the aircraft approached the airport for a landing. Our comments to the Federal Aviation Administration's (FAA) response to each of the three recommendations are as follows:

A-79-32. We are pleased to note that the FAA plans to issue an air carrier operations bulletin to emphasize to flightcrews the differences in fuel quantity measuring instruments and the possibility of misinterpretation of gage readings. We are maintaining this recommendation in an "Open--Acceptable Action" status.

A-79-33. We note that the FAA will issue a notice to engineering personnel reemphasizing the importance of cockpit configuration and instrumentation factors when approving engineering changes or issuing a supplemental type certificate. Pending the issuance of the notice, this recommendation is being maintained in an "Open--Acceptable Action" status.

A-79-34. To assure the adequacy of the fuel-quantity measuring and indicating system, we recommended that the FAA audit Supplemental Type Certificate SA 335 WE-D. We are pleased to note that this is being done and that we will be advised of the FAA's findings. This recommendation is also being maintained in an "Open--Acceptable Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

FEDERAL AVIATION ADMINISTRATION

OFFICE OF THE ADMINISTRATOR

July 23, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to National Transportation Safety Board Safety Recommendations A-79-32 through 34.

A-79-32. Issue an Operations Alert Bulletin to have FAA inspectors assure that crew training stresses differences in fuel-quantity measuring instruments and that crews flying with the new system are made aware of the possibility of misinterpretation of gage readings.

Comment. We plan to issue an air carrier operations bulletin to emphasize to flightcrews the differences in fuel quantity measuring instruments and the possibility of misinterpretation of gage readings. We expect to issue the bulletin within the next 90 days.

A-79-33. Emphasize to engineering personnel who approve aircraft engineering changes or issuance of Supplemental Type Certificates the need to consider cockpit configuration and instrumentation factors which can contribute to pilot confusion, such as the use of similar-appearing instruments with different scale factors.

Comment. The Federal Aviation Administration (FAA) does conduct a cockpit evaluation when there is a change to existing instruments by a change order to existing type design data or by a supplemental type certificate. Within the next 90 days we will issue a notice to appropriate FAA engineering personnel reemphasizing the importance of considering cockpit configuration and instrumentation factors when approving engineering changes or issuing supplemental type certificates.

A-79-34. Audit Supplemental Type Certificate SA3357WE-D for completeness, especially in the area of system calibration after installation.

Comment. A preliminary audit has been conducted and an official audit of the entire data file has been initiated. We expect to complete this audit within the next 90 days and will notify you of our findings.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 11, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-32 through -34

On December 28, 1978, a United Airlines DC-8 crashed near Portland, Oregon, after fuel exhaustion. As a result of its investigation, the Safety Board believes that the following safety-related findings merit corrective action.

The investigation showed that all four engines stopped because of fuel exhaustion as the aircraft approached Portland International Airport for a landing. An examination of the system components revealed no findings of any discrepancy which would have caused an erroneous fuel-quantity reading on any of the individual tank gages or on the total fuel gage. To the contrary, pertinent cockpit conversation as recorded on the cockpit voice recorder disclosed that 28.8 minutes before fuel was completely exhausted, the flight engineer was aware that only 5,000 pounds of fuel remained. Calculations, based on theoretical fuel consumption rates for the DC-8, showed this to be an accurate figure.

However, later in the flight, after it became apparent to the crew that engine flameout was imminent, the cockpit conversation indicated that the captain may have been confused as to the amount of fuel which actually remained. About 6 minutes before all engines stopped, the captain stated that there was 1,000 pounds of fuel in the No. 1 tank, and the second officer agreed with him.

Additional remarks were made at this same time by the captain describing the gage indication as changing from 1,000 pounds to 0 pounds. Since this gage does not change its indication from 1,000 pounds to 0 pounds directly but decreases in increments of 100 pounds, the captain must have read the gage indication incorrectly. Actually, the indication that he described is that of a gage changing from 100 pounds to 0 pounds.

In addition, the Safety Board learned that United Airlines had recently changed the fuel quantity gages on this aircraft from a direct reading digital-type to a three-figure indicator that must be multiplied by a factor of 100 to get the actual individual tank values. The new total fuel gage, with an identical display of the same three-figure presentation as the individual tank gages, must be multiplied by a factor of 1,000 to get the actual total fuel value.

The Safety Board believes that such a design can cause confusion because of the different scale multipliers that must be used. Unless crews are fully aware of this difference in scale, such an error can easily be made with the new system, especially at times of stress. Although crews can become familiar with the gages through training, an immediate problem exists because the gages are already installed on some aircraft. All crews who use this new fuel-quantity indicating system must be alerted to the possible confusion, or the need for two gage-scale corrections must be removed and one scale made common for all fuel-quantity indicators.

Finally, our investigation of the fuel-quantity measuring and indicating system disclosed that this new system being installed by United Airlines is authorized by Supplemental Type Certificate SA3357WE-D. This STC was issued by UAL under provisions of FAR's 21.431 through 21.493 and FAA Order No. 8110.4. In reviewing this STC, we found no evidence that the document specified precise methods of calibrating the system over its operating range after it was installed on an aircraft. The Safety Board has learned that the system is calibrated in two ways--at empty and at some random value of fuel after the first refueling following the modification. We believe that the FAA should audit this STC, as provided for in the FAR's, to assure its adequacy.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an Operations Alert Bulletin to have FAA inspectors assure that crew training stresses differences in fuel-quantity measuring instruments and that crews flying with the new system are made aware of the possibility of misinterpretation of gage readings. (Class II--Priority Action) (A-79-32)

U.S. Department of Transportation
Federal Aviation Administration

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

June 15, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-79-35 through A-79-39, issued June 1, 1979. This also responds to Safety Recommendation A-79-67, issued August 24, 1979, because of its close similarity to A-79-36.

This response supplements previous FAA letters dated August 29, 1979, and November 21, 1979, on this subject. Finally, this letter also responds to your recent requests for further progress reports dated February 25, 1981, (A-79-67) and February 27, 1981 (A-79-36 through 39).

We note that A-79-35 was classified in a "Closed--Acceptable Action" status by official Board action on April 9, 1980.

A-79-36. Amend 14 CFR 121.340 to require that all passenger-carrying air carrier aircraft be equipped with approved flotation-type seat cushions.

A-79-67. Amend 14 CFR 135 to require all aircraft conducting passenger service under Part 135 in any overwater operation be equipped with approved flotation-type seat cushions, and to require aircraft conducting extended overwater operations to also be equipped with an approved life preserver equipped with an approved survivor locator light.

FAA Comment. The Board, in its issuance of Recommendations A-79-35 through -39, expressed the opinion that all passenger-carrying aircraft should be equipped with flotation-type seat cushions so that passengers will have an immediate means of flotation when insufficient time is available to obtain more conventional flotation equipment (e.g., life preservers and/or life rafts). Recommendation A-79-36 specifically calls for a regulatory change to Part 121 to effect this, and Recommendation A-9-67 similarly calls for a regulatory change to Part 135. FAA agrees that in a few cases, including the Pensacola and St. Thomas accidents which led to these recommendations, such a change might have been worthwhile. Unfortunately, we also recognize that the regulatory changes recommended by the Board would be accompanied by costs. In Part 121 air carriers, the costs would include the following:

- Changes to seat-back placards;
- Changes to seat-pocket information cards;

- Changes to flight attendant training programs, and associated manuals and training documentation; and

- Increased fuel costs, owing to the (roughly estimated 6-ounce) increase in seat cushion weight;

In addition to the above, some Part 135 operators could be faced with relatively greater costs, as many smaller aircraft seats are not designed to accommodate removable seat cushions.

Before making a final determination on whether to accept these recommendations or not, I have directed my staff to provide me with an analysis of where we are, and our plans for the future, in regard to the whole question of survival aids in water landings. I have directed that they assemble the operational statistics, analyze them to project the risk we face, and present me with a summary of alternative means to mitigate those risks. I have also directed that, at the same time, they provide a detailed estimate of the costs of each alternative action. This effort will include consideration of all relevant data and recommendations from the Board, as well as information provided by Congressional oversight groups, and other interested organizations. This project will be conducted at the FAA Technical Center in response to requirements approved by the Office of Airworthiness.

I regret that our response is not more specific at this time, but am sure you will agree that the course of action I have outlined above is appropriate in light of the absence of adequate information to permit a careful evaluation of the costs and projected benefits of changes to these regulations.

A-76-37. Amend 14 CFR 121.571 to require that passengers be briefed on the location of approved flotation devices before each flight that requires the aircraft to pass over a large body of water during takeoff, departure, approach, or landing.

FAA Comment. As stated in our letter of August 29, 1979, Operations Review Program Proposal 5-14 to amend FAR, Section 121.571(a)(1)(iv) was adopted May 23, 1978. This section requires that all passengers be orally briefed before each takeoff on the location and use of any required emergency flotation means. In that letter we quoted an effective date of June 26, 1978. The actual revised effective date of the amendment was September 29, 1978. Copies of appropriate documents are enclosed. Accordingly, FAA considers action on Safety Recommendation A-79-37 completed.

A-79-38. Issue an Air Carrier Maintenance Bulletin instructing Maintenance Inspectors to emphasize to their assigned air carrier maintenance departments the need to maintain in a workable condition the closures of lifevest stowage pockets.

FAA Comment. Maintenance Bulletin No. 25-35, Life Preserver Stowage, was issued August 29, 1979 (copy enclosed). This Bulletin directed principal inspectors to review their assigned operators' procedures for maintenance and inspection of life preservers to ensure that while in service they are readily accessible and can be readily removed from the airplane if needed. Accordingly, FAA considers action on Safety Recommendation A-79-38 completed.

A-79-39. Expedite the issuance of the Notice of Proposed Rule Making which addresses revisions to TSO - C13c (14 CFR 37.123) for lifevests. The revisions to this TSO should eliminate the difficulties identified in this accident with respect to the packaging, donning, and operation of lifevests by uninstructed subjects under stress.

FAA Comment. The development of the draft TSO revision discussed in the August 29, 1979, FAA letter to the NTSB has been completed. Under procedures adopted in June 1980, an NPRM for a TSO revision is not required. Instead, the general public is informed of the pending TSO revision by a notice in the Federal Register, and is given the opportunity to comment and express views. We plan to announce the availability of the draft revision to TSO-C13c in the Federal Register in a matter of weeks.

Sincerely,

J. Lynn Helms
Administrator

Enclosures

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

FEB 27 19[illegible]

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Please refer to the Federal Aviation Administration's (FAA) letter of October 22, 1979, regarding Safety Recommendation A-79-36. We await your further response to this recommendation which we are maintaining in an "Open--Unacceptable Action" status. Related Safety Recommendations A-79-37 through 39, on the same greensheet, are maintained in an "Open--Acceptable Action" status. We request an updated status report on these three recommendations as well.

Sincerely yours,

James B. King
Chairman

National Transportation Safety Board
Washington, D.C. 20594

Office of Chairman

SEP 17 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Please refer to the Federal Aviation Administration's (FAA) letter of October 22, 1979, regarding Safety Recommendation A-79-36. We were told to expect the FAA's reconsideration of this recommendation shortly. We await your further response.

Sincerely yours,

James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

April 9, 1980

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to the National Transportation Safety Board's Safety Recommendation A-79-35 issued June 1, 1979. This was one of a group of five recommendations concerning passenger survival in aircraft ditchings, which stemmed from the Safety Board's investigation of a National Airlines Boeing 727 accident in the Escambia Bay at Pensacola, Florida, on May 8, 1978. We recommended that the Federal Aviation Administration (FAA):

> "Issue an Air Carrier Operations Bulletin requesting Principal Operations Inspectors to insure that air carrier training programs include instructions to crewmembers with respect to the availability, capabilities, and use of flotable seat cushions on their aircraft."

The Safety Board is pleased to note that Change 12 to FAA Order 8430.17 dated January 23, 1980, transmits a change to Air Carrier Operations Bulletin No. 1-80-1 fulfilling the recommendation. Safety recommendation A-79-35 is now classified in a "Closed--Acceptable Action" status.

Sincerely yours,

James B. King
Chairman

National Transportation Safety Board

Washington D C 20594

Office of the Chairman

October 17, 1979

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear Mr. Bond:

This is in response to your letter of August 29, 1979, in which you responded to Safety Recommendations A-79-35 through 39, issued by the National Transportation Safety Board on June 1, 1979.

The Safety Board is pleased that the FAA has initiated positive corrective actions in response to Safety Recommendations A-79-35 and A-79-37 through 39. The Board will carry these recommendations in an open-acceptable status. However, we have serious reservations with your staff's analysis of Safety Recommendation A-79-36.

The Safety Board agrees that life preservers are superior to flotation cushions when properly worn. However, the life preserver is of limited use when evacuation is time critical and passengers must evacuate an aircraft immediately or when they are thrown clear of an aircraft during inadvertent water impacts. In such circumstances the passenger may not have the time to locate and don a life preserver and flotation seat cushion may be the only flotation device that is readily available. Furthermore, the flotation seat cushion has at least three distinct advantages over the inflatable life preserver:

(1) It is readily found and removable;
(2) It does not require time to make it usable;
(3) It is a passive rescue device when it floats free of the cabin interior.

The circumstances of passenger survival in the National Airlines accident in Pensacola, Florida, and in the Antilles Air Boats accident near St. Thomas, V. I., clearly show the advantages of having approved flotation-type seat cushions designed to aid survivors in overwater operations. Thus, in addition to the requirement for more conventional life preservers, the Board is of the opinion that approved

flotation-type seat cushions should be a requirement in any overwater operation.

In view of the above, the Safety Board urges that you reconsider Safety Recommendation A-79-36.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

November 21, 1979

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-79-67.

A-79-67. Amend 14 CFR 135 to require all aircraft conducting passenger service under Part 135 in any overwater operation be equipped with approved flotation-type seat cushions, and to require aircraft conducting extended overwater operations to also be equipped with an approved life preserver equipped with an approved survivor locator light.

Comment. The Board, in Safety Recommendation A-79-36, made similar recommendations in respect to passenger-carrying air carrier aircraft. After responding to the Board's recommendation, the Federal Aviation Administration received a request for reconsideration which reflects the Board's belief that both life preservers, which are acknowledged to be superior, and floatation cushions should be provided under the hypotheses that evacuation time may be critical or that passengers may be thrown clear of the aircraft along with the floating seat cushions. The rationale used by the Board would be equally applicable to our response to the above recommendation.

We are continuing our review of this recommendation or alternatives which may satisfy the intent of the recommendation, together with your request in respect to A-79-36. We believe that the evaluation upon which our decision will be based will be completed in several months. We will further advise you at that time.

Sincerely,

Langhorne Bond
Administrator

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

August 29, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to National Transportation Safety Board Safety Recommendations A-79-35 through 39.

A-79-35. Issue an Air Carrier Operations Bulletin requesting Principal Operations Inspectors to insure that air carrier training programs include instructions to crewmembers with respect to the availability, capabilities, and use of flotable seat cushions on their aircraft.

Comment. We will initiate a project to develop an air carrier operations bulletin requesting that principal operations inspectors ensure that the air carriers' training programs include instructions to crewmembers with respect to the availability, capabilities, and use of flotation-type cushions on their aircraft. We expect to issue this bulletin by September 30, 1979.

A-79-36. Amend 14 CFR 121.340 to require that all passenger-carrying air carrier aircraft be equipped with approved flotation-type seat

Comment. Section 121.340 requires either a life preserver or an approved flotation means for each airplane occupant unless the carrier can show that it does not operate over any body of water for which a flotation means would be needed. Considering charter flights and the number of large lakes, rivers, etc., throughout the Unites States, no air carrier can operate without life preservers or an approved flotation-type seat cushion in today's environment. Since the life preserver is superior to a flotation-type seat cushion as a life-saving device, we do not believe that flotation-type cushions are necessary when life preservers are being carried.

Actions underway with respect to Recommendation A-79-35 will ensure that crewmembers have knowledge of the equipment on board. This, in addition to the passenger briefing required by Section 121.571, should provide an adequate level of safety in this area.

A-79-37. Amend 14 CFR 121.571 to require that passengers be briefed on the location of approved flotation devices before each flight that requires the aircraft to pass over a large body of water during takeoff, departure, approach, or landing.

Comment. Operations Review Program Proposal 5-14 to amend FAR, Section 121.571(a)(1)(iv) was adopted May 23, 1978, with an effective date of June 26, 1978. This section requires that all passengers be orally briefed before each takeoff on the location and use of any required emergency flotation means.

A-79-38. Issue an Air Carrier Maintenance Bulletin instructing Maintenance Inspectors to emphasize to their assigned air carrier maintenance departments the need to maintain in a workable condition the closures of lifevest stowage pockets.

Comment. We will issue an air carrier maintenance bulletin instructing maintenance inspectors to emphasize to their assigned carriers the need to maintain lifevest stowage pocket closures in operable condition.

A-79-39. Expedite the issuance of the Notice of Proposed Rule Making which addresses revisions to TSO - C13c (14 CFR 37.123) for lifevests. The revisions to this TSO should eliminate the difficulties identified in this accident with respect to the packaging, donning, and operation of lifevests by uninstructed subjects under stress.

Comment. We are preparing a revision to the life preserver performance standards under Technical Standard Order TSO-C13c which will include updated provisions for stowage and donning. ~~We are processing a Notice~~ of Proposed Rule Making and intend to issue the notice as expeditiously as possible.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

H

ISSUED: June 1, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-35 through -39

On May 8, 1978, a National Airlines Boeing 727 crashed during an approach to the Pensacola Regional Airport at Pensacola, Florida. The aircraft came to rest in 12 feet of water in the Escambia Bay about 3 miles off shore. The 52 passengers and 6 crewmembers successfully evacuated from the aircraft, and 3 passengers drowned. Two flight attendants and two passengers were injured seriously, and seven passengers were injured slightly.

There was no warning of the impact and no "preditching" preparation was made. Although decelerative forces were moderate, the cabin floor under the last two seat rows was destroyed and the aft tail cone access door (with its jumpseat) separated from the aircraft structure. The aft cabin was inundated almost immediately and water was about 4 feet deep in the forward cabin when the aircraft came to rest on the bottom of the bay.

As the aircraft settled tail-first in the water, the occupants evacuated from six of the eight exits. The survivors experienced several difficulties with emergency equipment both during and after the evacuation.

Seat Cushions -- The aircraft was not equipped, nor was it required to be equipped, with approved flotation-type seat cushions. However, at least 14 passengers said that they used or attempted to use the cushions for flotation; several passengers assumed that seat cushions in all aircraft could be used for flotation. Two crewmembers said that they had assumed that the cushions were approved flotation devices and two other crewmembers were not sure.

At the Safety Board's request, the Air Transport Association surveyed 25 member airlines to determine which air carriers equip their aircraft with flotation-type cushions. The survey revealed that of the 23 air carriers, 13 have approved flotation cushions on all aircraft, 3 have no flotation cushions, and 9 have a mixed fleet -- some aircraft equipped with these devices and others not so equipped. The Board is of the opinion that all passenger

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carrying aircraft should be equipped with flotation-type seat cushions so that passengers will have an immediate means of flotation when insufficient time is available to obtain more conventional flotation equipment.

Lifevests -- The survivors experienced numerous problems with locating, removing, unpacking, donning, and inflating lifevests, because they either did not have time to obtain them or they did not realize that the aircraft was in the water. Crewmembers either threw lifevests to passengers who were in the water or swam and carried lifevests to the passengers.

Forty-nine passengers responded to a Safety Board questionnaire that elicited information on difficulties experienced with the flotation devices. Twenty-two percent of the respondents had never seen a demonstration of how to don a lifevest. Demonstrations were not required and none were given on the previous two legs of this flight; however, 20 passengers who were onboard the aircraft for the Tampa-New Orleans segment of the flight did receive such a demonstration. Fourteen percent had no problems obtaining vests from beneath their seats, but others had difficulty locating and removing vests from the fabric pouches underneath their seats. Over 32 percent of those responding had difficulty donning their lifevests and at least 8 percent reported difficulty in unpacking their vests from the sealed plastic bags. Over 18 percent had difficulty inflating their vests. Most of the lifevests recovered after the accident had only one of the two chambers inflated. Few passengers were able to properly fasten and tighten the vest adjustment straps.

Almost 9 years ago, as a result of the Overseas National Airlines DC-9 ditching in the Caribbean on May 2, 1970, the Safety Board, in Safety Recommendation CY-70-46, recommended that the FAA "Reexamine the methods utilized aboard aircraft for holding lifevests with a view towards eliminating any obstructions to expeditious access in the event of an emergency requiring them." The accident at Pensacola shows that this problem still exists. The Safety Board believes that inadequate maintenance of the closure devices of the storage pockets may cause this problem.

On June 28, 1972, the Safety Board recommended that the FAA "Reexamine the applicable Technical Standard Order governing the design and manufacture of lifevests with a view toward development of more comfortable, standardized, and less complicated lifevests for use in air carrier aircraft." (Recommendation A-72-64)

Our staff has learned informally that the FAA is preparing a Notice of Proposed Rule Making which is based largely on Aerospace Recommended Practice 1354 entitled "Individual Inflatable Life Preservers," issued in January 1976 by the Society of Automotive Engineers' Cabin Safety Provisions Committee.

Our informal information from FAA personnel suggests that the modification of TSO - C13c for lifevests addressed in this NPRM may alleviate many of the problems common to both the Overseas National and National Airlines accidents.

Liferafts and Slides -- The aircraft was not equipped with liferafts. Although the Tampa - New Orleans segment of this flight involved extended overwater operations as defined by 14 CFR 1.1, an amendment to the carrier's Operations Specifications granted by the FAA on July 19, 1977, authorized National Airlines to operate this flight without liferafts. The aircraft was equipped with four evacuation slides; none were deployed, however, despite the fact that the crewmembers had received training and instructions in the value and use of these slides as emergency flotation devices. The Safety Board believes that, had one or more of these evacuation slides been used, fewer persons might have died in the accident.

The adequacy of flotation equipment availability in air carrier aircraft goes beyond this immediate accident. Almost 7 years ago, as a result of a Special Study on the Overseas National accident, the Safety Board recommended that the FAA expedite the development and installation of slide/raft combinations in air carrier aircraft. (Recommendation A-72-65) In that accident, none of the liferafts were launched successfully; however, an evacuation slide was deployed which saved many lives by serving as a rallying point for the survivors. The Safety Board believes that technology presently is available to develop slide/rafts for narrow-bodied aircraft as has been done for the wide-bodied aircraft; however, the FAA must provide the impetus for such a project if it is to be brought about in a timely fashion. We believe that the issuance of a Technical Standard Order (TSO) on slide/raft devices for all large passenger-carrying aircraft would be a step in that direction. Safety Recommendation A-79-19, recommending the issuance of such a TSO was issued by the Board on April 17, 1979.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an Air Carrier Operations Bulletin requesting Principal Operations Inspectors to insure that air carrier training programs include instructions to crewmembers with respect to the availability, capabilities, and use of flotable seat cushions on their aircraft. (Class II - Priority Action) (A-79-35)
>
> Amend 14 CFR 121.340 to require that all passenger-carrying air carrier aircraft be equipped with approved flotation-type seat cushions. (Class II - Priority Action) (A-79-36)

Amend 14 CFR 121.571 to require that passengers be briefed on the location of approved flotation devices before each flight that requires the aircraft to pass over a large body of water during takeoff, departure, approach, or landing. (Class II - Priority Action) (A-79-37)

Issue an Air Carrier Maintenance Bulletin instructing Maintenance Inspectors to emphasize to their assigned air carrier maintenance departments the need to maintain in a workable condition the closures of lifevest stowage pockets. (Class II - Priority Action) (A-79-38)

Expedite the issuance of the Notice of Proposed Rule Making which addresses revisions to TSO - C13c (14 CFR 37.123) for lifevests. The revisions to this TSO should eliminate the difficulties identified in this accident with respect to the packaging, donning, and operation of lifevests by uninstructed subjects under stress. (Class II - Priority Action) (A-79-39)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and HOGUE, Members concurred in the above recommendations.

By: James B. King
Chairman

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

February 25, 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Reference is made to National Transportation Safety Board Safety Recommendation A-79-67 issued August 24, 1979. The Federal Aviation Administration's (FAA) response of November 21, 1979, indicated that this recommendation was under review and that we would be advised of the FAA's decision. In order to evaluate its present status and update the public docket, we request a further progress report.

Sincerely yours,

James B. King
James B. King
Chairman

Office of the
Chairman

National Transportation Safety Board

Washington, D.C. 20594

December 17, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of November 21, 1979, responding to the National Transportation Safety Board's Safety Recommendation A-79-67. This recommendation was developed from our investigation of the Antilles Air Boats Grumman G-21A accident in the Virgin Islands, on September 2, 1978, and dealt with life preserver equipment.

Pending completion of the Federal Aviation Administration's (FAA) ongoing evaluation of the recommendation or alternatives concerning life preserver equipment, and receipt of additional information from the FAA, A-79-67 will be classified as "Open--Acceptable Action."

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

November 21, 1979

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-79-67.

A-79-67. Amend 14 CFR 135 to require all aircraft conducting passenger service under Part 135 in any overwater operation be equipped with approved flotation-type seat cushions, and to require aircraft conducting extended overwater operations to also be equipped with an approved life preserver equipped with an approved survivor locator light.

Comment. The Board, in Safety Recommendation A-79-36, made similar recommendations in respect to passenger-carrying air carrier aircraft. After responding to the Board's recommendation, the Federal Aviation Administration received a request for reconsideration which reflects the Board's belief that both life preservers, which are acknowledged to be superior, and floatation cushions should be provided under the hypotheses that evacuation time may be critical or that passengers may be thrown clear of the aircraft along with the floating seat cushions. The rationale used by the Board would be equally applicable to our response to the above recommendation.

We are continuing our review of this recommendation or alternatives which may satisfy the intent of the recommendation, together with your request in respect to A-79-36. We believe that the evaluation upon which our decision will be based will be completed in several months. We will advise you at that time.

Sincerely,

Original signed by:

LANGHORNE BOND
Administrator

National Transportation Safety Board

Washington D C 20594

Office of the Chairman

October 17, 1979

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear Mr. Bond:

This is in response to your letter of August 29, 1979, in which you responded to Safety Recommendations A-79-35 through 39, issued by the National Transportation Safety Board on June 1, 1979.

The Safety Board is pleased that the FAA has initiated positive corrective actions in response to Safety Recommendations A-79-35 and A-79-37 through 39. The Board will carry these recommendations in an open-acceptable status. However, we have serious reservations with your staff's analysis of Safety Recommendation A-79-36.

The Safety Board agrees that life preservers are superior to flotation cushions when properly worn. However, the life preserver is of limited use when evacuation is time critical and passengers must evacuate an aircraft immediately or when they are thrown clear of an aircraft during inadvertent water impacts. In such circumstances the passenger may not have the time to locate and don a life preserver and flotation seat cushion may be the only flotation device that is readily available. Furthermore, the flotation seat cushion has at least three distinct advantages over the inflatable life preserver:

(1) It is readily found and removable;
(2) It does not require time to make it usable;
(3) It is a passive rescue device when it floats free of the cabin interior.

The circumstances of passenger survival in the National Airlines accident in Pensacola, Florida, and in the Antilles Air Boats accident near St. Thomas, V. I., clearly show the advantages of having approved flotation-type seat cushions designed to aid survivors in overwater operations. Thus, in addition to the requirement for more conventional life preservers, the Board is of the opinion that approved

flotation-type seat cushions should be a requirement in any overwater operation.

In view of the above, the Safety Board urges that you reconsider Safety Recommendation A-79-36.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

August 29, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to National Transportation Safety Board Safety Recommendations A-79-35 through 39.

A-79-35. Issue an Air Carrier Operations Bulletin requesting Principal Operations Inspectors to insure that air carrier training programs include instructions to crewmembers with respect to the availability, capabilities, and use of flotable seat cushions on their aircraft.

Comment. We will initiate a project to develop an air carrier operations bulletin requesting that principal operations inspectors ensure that the air carriers' training programs include instructions to crewmembers with respect to the availability, capabilities, and use of flotation-type cushions on their aircraft. We expect to issue this bulletin by September 30, 1979.

A-79-36. Amend 14 CFR 121.340 to require that all passenger-carrying air carrier aircraft be equipped with approved flotation-type seat cushions.

Comment. Section 121.340 requires either a life preserver or an approved flotation means for each airplane occupant unless the carrier can show that it does not operate over any body of water for which a flotation means would be needed. Considering charter flights and the number of large lakes, rivers, etc., throughout the Unites States, no air carrier can operate without life preservers or an approved flotation-type seat cushion in today's environment. Since the life preserver is superior to a flotation-type seat cushion as a life-saving device, we do not believe that flotation-type cushions are necessary when life preservers are being carried.

Actions underway with respect to Recommendation A-79-35 will ensure that crewmembers have knowledge of the equipment on board. This, in addition to the passenger briefing required by Section 121.571, should provide an adequate level of safety in this area.

A-79-37. Amend 14 CFR 121.571 to require that passengers be briefed on the location of approved flotation devices before each flight that requires the aircraft to pass over a large body of water during takeoff, departure, approach, or landing.

Comment. Operations Review Program Proposal 5-14 to amend FAR, Section 121.571(a)(1)(iv) was adopted May 23, 1978, with an effective date of June 26, 1978. This section requires that all passengers be orally briefed before each takeoff on the location and use of any required emergency flotation means.

A-79-38. Issue an Air Carrier Maintenance Bulletin instructing Maintenance Inspectors to emphasize to their assigned air carrier maintenance departments the need to maintain in a workable condition the closures of lifevest stowage pockets.

Comment. We will issue an air carrier maintenance bulletin instructing maintenance inspectors to emphasize to their assigned carriers the need to maintain lifevest stowage pocket closures in operable condition.

A-79-39. Expedite the issuance of the Notice of Proposed Rule Making which addresses revisions to TSO - C13c (14 CFR 37.123) for lifevests. The revisions to this TSO should eliminate the difficulties identified in this accident with respect to the packaging, donning, and operation of lifevests by uninstructed subjects under stress.

Comment. We are preparing a revision to the life preserver performance standards under Technical Standard Order TSO-C13c which will include updated provisions for stowage and donning. We are processing a Notice of Proposed Rule Making and intend to issue the notice as expeditiously as possible.

Sincerely,

Langhorne Bond

Langborne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: August 24, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-67

On September 2, 1978, an Antilles Air Boats, Inc., Grumman 21A, struck the water while on a passenger flight from St. Croix to St. Thomas in the Virgin Islands. The aircraft broke apart and the captain and 3 of the 10 passengers drowned.

The aircraft was not required to have liferafts or approved flotation-type seat cushions on board, nor was it so equipped. Individual life preservers were located underneath each seat.

The Board's investigation revealed that before takeoff the captain only advised the passengers to fasten their seatbelts; he did not brief them on the location of survival equipment as was required by 14 CFR 135.81, "Briefing of Passengers Before Flight," which was in effect at that time. Thus, putting aside whether sufficient time had been available to retrieve and don the life preservers, the passengers may not have known about the availability of them. In fact, no warning of an impending emergency landing was given to the passengers.

Seven of the 10 passengers survived because they clung to floating aircraft debris. Several passengers attempted to use seat cushions; however, these cushions were covered with a vinyl material which became too slippery to hold in the water. There were no straps or handholds to facilitate grasping the cushions.

The Safety Board's accident investigation experience shows that, in many cases in which aircraft inadvertently crash in water, the most readily available means of flotation is seat cushions. The most recent example was the National Airlines Boeing 727 accident near Pensacola, Florida, on May 8, 1978. Although life preservers were made available to

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some passengers in this case, many did not have time to obtain a life preserver because the cabin was inundated almost immediately. Many passengers had to rely on the seat cushions which were not approved flotation devices. As a result, the Board recommended that the Federal Aviation Administration amend 14 CFR 121.340 to require that all passenger-carrying air carrier aircraft be equipped with approved flotation-type seat cushions (Safety Recommendation A-79-36).

The Antilles Air Boats accident again shows the need for a readily available means of flotation in water accidents when insufficient time is available to retrieve and don more conventional flotation equipment. Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend 14 CFR 135 to require all aircraft conducting passenger service under Part 135 in any overwater operation be equipped with approved flotation-type seat cushions, and to require aircraft conducting extended overwater operations to also be equipped with an approved life preserver equipped with an approved survivor locator light. (A-79-67) (Class II - Priority Action)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 11, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-79-44 issued June 5, 1979, and supplements our letter of August 29, 1979. This recommendation stemmed from the NTSB Special Study, "Single-Engine, Fixed-Wing General Aviation Accidents, 1972-1976."

The Federal Aviation Administration's (FAA) response of August 29, 1979, suggested that such data were already available from accident investigations, but the Board's followup letter adopted the position that such information could not be derived from accident data. Accordingly, this recommendation was discussed at both FAA/NTSB Quarterly Meetings held on March 12, 1980, and February 12, 1981.

During these meetings, it was stated that the pilot is cited as a cause or related factor in almost 85 percent of all general aviation accidents, but a lack of data regarding the nonaccident general aviation pilot population precluded the effective assessment of the pilot's role in accidents. For the development of safety proposals to minimize such accidents, there is a critical need for such information as flight experience (total flight time, time in type, recency, multi-engine time), type of certificate, age, medical waivers, and IFR or other weather experience. The logic of this recommendation was discussed at length in view of the magnitude of the request and expense involved. The FAA contended that the relationship between successful flights, by pilots of any qualifications or experience, under conditions which are themselves subject to innumerable variables, is rather obscure. Despite these misgivings, the FAA agreed to reconsider the recommendation in conjunction with the NTSB/FAA working group on improving and expanding the data system.

A-79-44. Generate, through a stratified sampling of general aviation pilots, the date, duration, aircraft make and model, the geographical location of the flight, and the flight time in IFR, high density altitude, and wind conditions, all on a per flight basis; the data

collected should include the pilot's total time, time in each type aircraft flown, age, occupation, certificate, and medical waivers.

FAA Comment. As you are aware, FAA formed a committee in the autumn of 1980 which sought to identify human factors/exposure data and the alternatives to acquiring these data. This committee, consisting of representatives from NTSB, TSC, and FAA, has discussed several alternatives and associated implementation time frames and costs. Additionally, the Office of Aviation Safety is assessing the applicability of an analytical study presently being developed on the overall subject of General Aviation Safety. The results of that assessment will be presented to the full committee in the near future. As a result of this total approach we anticipate the adoption of a mutually acceptable program dealing with this subject.

We will keep the Board informed of significant progress in this area as our efforts continue.

Sincerely,

J. Lynn Helms
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

October 1, 1979

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of August 29, 1979, and enclosed Report No. FAA-MS-79-5, responding to the National Transportation Safety Board's (NTSB) recommendation A-79-44. Our recommendation stemmed from the NTSB Special Study, "Single-Engine, Fixed-Wing General Aviation Accidents 1972-1976."

Because the lack of exposure data is preventing the effective assessment of the role of the pilot and the environment in these accidents, we requested the Federal Aviation Administration (FAA) to provide the Safety Board with a sampling of data relative to the pilot and the flight environment.

We do not agree with the FAA's response that the exposure data, requested by the Safety Board, can be derived from aircraft accident reports. We, therefore, intend to make this recommendation an agenda item for discussion at the next NTSB/FAA Quarterly Meeting where we will also discuss the adequacy of NTSB Accident Reporting Forms 6120.1 and 6120.2. For the present, we are maintaining A-79-44 in an "Open--Unacceptable Action" status.

Sincerely yours,

James B. King
James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

August 29, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to National Transportation Safety Board (NTSB) Safety Recommendation A-79-44.

A-79-44. Generate, through a stratified sampling of general aviation pilots, the date, duration, aircraft make and model, the geographical location of the flight, and the flight time in IFR, high density altitude, and wind conditions, all on a per flight basis; the data collected should include the pilot's total time, time in each type aircraft flown, age, occupation, certificate, and medical waivers.

Comment. We have carefully reviewed the recommendation and the NTSB-AAS-79-1, "Special Study - Single-Engine, Fixed-Wing General Aviation Accidents, 1972-1976." The exposure data, said to be useful to the assessment of pilot role in aircraft accidents, is information which is already available to you in respect to accidents which have occurred and which have been properly investigated. We are convinced that data obtained from a sampling of accident reports will produce substantially the same exposure data as that which might be derived from a sampling of pilots who have not been involved in accidents.

The current approach used by the Federal Aviation Administration (FAA) to obtain exposure information is based on a random sample technique. This technique was recently introduced and the results of its first application are contained in the enclosed document, "1977 General Aviation Activity and Avionics Survey," (April 1979). The information contained in this document does not contain information in the detail suggested in this recommendation. It does contain all information which could be effectively collected under present circumstances. General aviation exposure information is available to us only on a voluntary basis.

We suggest that the FAA and NTSB coordinate in identifying additional pilot exposure data, if any, which can be included in NTSB Accident Reporting Forms 6120.1 and 6120.2.

This is in consonance with our April 27 response to your letter of February 28 which deals with your Safety Objective Project as it relates to general aviation accident injury studies.

The FAA General Aviation Accident Data System can be utilized for exposure data acquisition and storage so that real time information will be available for the identification of trends.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosure

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: June 5, 1979

Forwarded to:

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)
A-79-44

The National Transportation Safety Board has studied statistically its data files of 17,312 accidents that occurred from 1972 to 1976 and involved *light, single-engine, fixed-wing aircraft (single-engine aircraft)*. Single-engine aircraft accounted for approximately 72 percent of all general aviation flying hours from 1972 to 1976, about 81 percent of the accidents, 76 percent of the fatal accidents, and 69 percent of the fatalities. Clearly, single-engine aircraft accidents are the most significant segment of general aviation in terms of activity and loss.1/

Contingency table analyses were used to ascertain the role of the aircraft, the pilot, and the environment in single-engine aircraft accidents. All single-engine aircraft makes and models with more than 500 active aircraft in 1976 were included in the study, excluding those aircraft specifically designed and produced for aerial application flying. This resulted in the inclusion of 33 aircraft makes and models in the study.

The Safety Board's attempts to assess the effect of pilot characteristics such as experience (total flight time, time in type, and time last 90 days), type of certificate, age, and medical waivers, and the effects of environment, including flight in IFR conditions, unfavorable winds, high density altitude, and terrain led to the conclusion: A lack of exposure data is preventing the effective assessment of the role of the pilot and the environment in these accidents. A precise understanding of the observations and thus the development of remedial action will depend on a determination of the role of the pilot. Thus, the Safety Board concludes that the Federal Aviation Administration should begin to collect adequate exposure data. This need was also recognized at the Aircraft Operators Pilot Association Air Safety Foundation/General Aviation Manufacturers Association Safety Workshop held in January 1979.

1/ For more detailed information, read "Special Study—Single-engine, Fixed-wing General Aviation Accidents, 1972-1976" (NTSB-AAS-79-1).

The mean fatal accident rate per 100,000 hours of the Cessna-built aircraft included in this study (1.65) was significantly lower than the mean fatal accident rates of the other five manufacturers still producing aircraft—Beech (2.54), Bellanca (4.84), Grumman (4.13), Mooney (2.50), and Piper (2.48).

The Bellanca 14-19, the Beech 35 (V-tail), and the Piper PA-24 accounted for over one-third of all in-flight airframe failures of the selected group of 33 single-engine aircraft reviewed in this study. All three aircraft had in-flight airframe failure rates significantly higher than the mean rate of the selected group of 33 aircraft; the Bellanca 14-19 had the highest rate of all the aircraft at 1.49 per 100,000 flying hours. The Beech 35 (V-tail) had a mean airframe failure rate of 0.58, and the Piper PA-24 rate was 0.42.

The Cessna 150 and Piper PA-28 account for almost half of the midair collisions involving the selected group of aircraft. The influence of instructional flying on these accidents is not known, but it could be significant.

Older model aircraft appeared to be associated with high rates of fatal and nonfatal accidents. Many of the older aircraft are tailwheel configured, and the association with ground loop accidents was obvious. The high rate of stall accidents among older aircraft and among tailwheel aircraft is possibly related to higher power loading.

Much additional research is necessary to determine the relationships of the various factors in the observations cited above, but the potential rewards of increased safety and decreased accident losses should be well worth the effort.

Based on the results of this study, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Generate, through a stratified sampling of general aviation pilots, the date, duration, aircraft make and model, the geographical location of the flight, and the flight time in IFR, high density altitude, and wind conditions, all on a per flight basis; the data collected should include the pilot's total time, time in each type aircraft flown, age, occupation, certificate, and medical waivers. (Class II, Priority Action) (A-79-44)

KING, Chairman, DRIVER, Vice Chairman, and McADAMS and HOGUE, Members, concurred in the above recommendation.

James B King

By: James B. King
Chairman

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Thank you for your letter dated April 24, 1981, further responding to National Transportation Safety Board Safety Recommendations A-79-53 and -54 issued June 27, 1979. These recommendations stemmed from our investigation of two accidents involving Hiller UH-12EJ3 model helicopters in which the mechanical flight control system malfunctioned.

In Safety Recommendation A-79-53 we recommended that the Federal Aviation Administration (FAA) issue an Airworthiness Directive requiring compliance with Hiller Service Letter 302, dated October 2, 1978. Our original concern was that the hollow shank rod ends were not structurally adequate under normal flight loadings. We are satisfied that the results of the FAA's investigation indicate otherwise. We also agree that if the manufacturer's 100 hour maintenance requirements are followed, the possibility of additional service problems is minimized.

In Safety Recommendation A-79-54 we recommended that the FAA establish a retirement time for components of the UH-12 model helicopter's mechanical flight control system which are subjected to constant vibratory stresses. We were concerned that the installation of the Allison 250-C20 turboshaft engine in the UH-12 might introduce a different vibratory environment to the mechanical flight control system thus affecting fatigue life. The FAA's response now assures us that the safe life determined during the UH-12 certification program is valid and is not adversely affected by the turboshaft engine installation.

We thank the FAA for the consideration given to both Safety Recommendations A-79-53 and -54 which we now classify in a "Closed--Reconsidered" status.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 24, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-79-53 and 54 issued June 27, 1979, and supplements our letter of September 25, 1979. This also responds to your letter of October 21, 1980, in which you asked to be informed of the results of our investigation.

A-79-53. Issue an Airworthiness Directive requiring compliance with Hiller Service Letter 30-2, dated October 2, 1978.

FAA Comment. The Federal Aviation Administration (FAA) has completed its investigation and the following comments are applicable to our findings.

Based on the NTSB investigation, the accidents involved were attributed to: (1) an overload caused by ground impact; and (2) a reversed bending failure of the hollow shank rod end. The cause of the bending failure in the shank was never resolved. However, shank fatigue failures can only occur if the bearing itself becomes nonfunctional or frozen by corrosion. It was never established that corrosion of the hollow shank rod ends was contributory to these accidents. Also, the manufacturer's maintenance manual calls for periodic inspection of the control system parts. Hiller recommends an inspection of these parts every 100 hours as part of the normal maintenance program. If this maintenance is not performed properly, then service difficulties may occur.

The Hiller Service Letter requesting all owners of UH-12 series helicopters to replace the hollow shank rod end bearings, although they are structurally adequate for normal loading, was not based on safety considerations. Rather, it was considered a design improvement to preclude the possibility of internal corrosion. In addition, Hiller is replacing all hollow shank rod end bearings in stock with the solid shank bearings.

Accordingly, it is our assessment that mandatory action to incorporate solid rod ends or to assure periodic lubrication is not necessary. Normal maintenance with periodic lubrication of the bearings is considered adequate. We have determined, therefore, that Airworthiness Directive action is inappropriate and we do not intend to require compliance with Hiller Service Letter No. 30-2 dated October 2, 1978.

A-79-54. Establish a retirement time for components of the UH-12 model helicopter's mechanical flight control system which are subjected to constant vibratory stresses.

FAA Comment. We believe this matter was adequately addressed in the type certification program.

The component stresses, both vibratory and steady, in the mechanical flight control system are determined during the flight strain survey program and a fatigue analysis or fatigue test establishes the life limits of these component parts. The UH-12 model helicopter's mechanical flight control system push-pull rods have safe lives established during type certification that vary from 12,000 to over 40,000 flight hours. The rod ends have safe lives in excess of the rods and, since the rods and ends are replaced as a complete assembly, there is no need to establish a separate retirement life for the rod ends. Accordingly, we do not intend to pursue this matter further.

In view of our findings, we believe these actions constitute an adequate response to these deficiencies which were of concern to the Board. Accordingly, the FAA considers action completed on Safety Recommendations A-79-53 and A-79-54.

Sincerely,

J. Lynn Helms
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

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Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Please refer to your letter dated September 25, 1979, responding to National Transportation Safety Board Safety Recommendations A-79-53 and 54 issued June 27, 1979, and our response of November 7, 1979. These recommendations stemmed from our investigation of two accidents involving Hiller UH-12EJ3 helicopters in which the mechanical flight control systems malfunctioned. Both recommendations are held in an "Open--Acceptable Alternate Action" status.

Your letter indicated that, among other actions, an investigation was being conducted to determine the need for periodic lubrication of rod end bearings installed in the Hiller UH-12 mechanical flight control system. In order to evaluate the progress of these recommendations and update the public docket, we request to be informed of the results of the investigation.

Sincerely yours,

James B. King

James B. King
Chairman

National Transportation
Safety Board

Washington, D.C. 20594

Office of
Chairman

November 7, 1979

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter dated September 25, 1979, responding to the National Transportation Safety Board's Safety Recommendations A-79-53 and 54. These recommendations stemmed from our investigation of two accidents involving Hiller UH-12EJ3 helicopters in which the mechanical flight control systems malfunctioned.

In A-79-53 the Safety Board recommended that the Federal Aviation Administration (FAA) issue an Airworthiness Directive (AD) requiring compliance with Hiller Service Letter 30-2, dated October 2, 1978. This would require operators to ensure that the correct rod end is installed and that hollow shank rods identified as HPP-RE-65 are removed from stock. Our statement regarding the HPP-RE-65 hollow shank rod ends not meeting specifications was taken from the text of the Hiller Aviation Service Letter.

We understand from the FAA's response that after issuing the Service Letter the manufacturer finds the hollow shank rod ends to be capable of withstanding the normal loads of the system. We also note that the FAA is assessing the criticality of the change in design and is determining whether the installation of the solid shank rod end will contribute to safety.

In A-79-54 we recommended that the FAA establish a retirement time for components of the UH-12 model mechanical flight control system which are subjected to constant vibratory stresses. This recommendation stemmed from our concern that the extended service life of the aircraft, brought about by the turboshaft engine modification, could adversely affect the original certification substantiation data of the mechanical flight control system. We note that the FAA considers the rationale for the "infinite life" established for the components of the system to be valid. We also note from the FAA's response that a "frozen" bearing

caused abnormal bending stresses in the rod end shank leading to fatigue, and that a reasonable engineering approach to the problem would be to investigate the need for periodic lubrication of the rod bearings. At this time we cannot identify additional failures of the mechanical flight control system. In the absence of further technical justification to support our recommendation, we accept the FAA's rationale and engineering approach to the problem. Pending the FAA's final determination of the need for an AD, both A-79-53 and 54 are being maintained in an "OPEN--ACCEPTABLE ALTERNATE ACTION" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

September 25, 1979

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-79-53 and 54.

A-79-53. Issue an Airworthiness Directive requiring compliance with Hiller Service Letter 30-2, dated October 2, 1978.

Comment. The solid shank rod end HPP-RE-64 or -65, which designate upper and lower parts, (designated HPP-RE-65 in your recommendation letter) is a design improvement recommended by the manufacturer. Your analysis, upon which this recommendation is based, states that "A review of manufacturing specifications indicated that hollow shank rod ends do not meet the design requirements for installation with cyclic isolation link PN 3001-35." This, in our initial contact with the manufacturer, was not substantiated and we ask that you furnish us with the basis for this finding.

At this time we find that Hiller Aviation issued Service Letter 30-2, dated October 2, 1978, subsequent to the subject accident, which recommended that all owners/operators inspect all aircraft to verify that solid shank rod end assemblies were installed and remove all hollow shank rod ends from the spare parts inventory. However, they now state "that the hollow shank rod ends are structurally adequate for the normal loads in this system."

We have been advised by Hiller Aviation that, with reference to the accident upon which this recommendation is based, "the ultimate failure of the particular rod end was through the shank. Also, further information indicated that the ball was frozen in the housing which could cause high bending loads in the rod end shanks." We are, therefore, assessing the criticality of the change in design and whether requiring installation of the solid part will contribute to safety. We are also investigating the contribution of bearing lubrication to the rod failure and will consider requiring periodic lubrication.

If we determine not to issue an Airworthiness Directive requiring the installation of the solid shank rod end, we will investigate the issue of improperly marked hollow shank rod ends and, if necessary, we will issue an Airworthiness Directive to preclude installation of hollow shank rod ends which, because of improper marking, appear to be in compliance with the manufacturer's recommendation.

A-79-54. Establish a retirement time for components of the UH-12 model helicopter's mechanical flight control system which are subjected to constant vibratory stresses.

Comment. The components of the UH-12 model helicopter's mechanical flight control system were established as having "infinite life" during the type certification program.

It is not reasonable to establish a retirement time limit for these components unless the substantiation data used as the basis for the initial certification is shown to be unconservative. Further, the recommendation may be overly broad since it does not distinguish between the several components of the mechanical flight control system, nor does it specify the significance or magnitude of "constant vibratory stresses" as they may relate to such components. These are presumably factors asssessed in the application of regulatory criteria, e.g., 14 CFR 25.571, which must be reevaluated in respect to your findings. Thus, we must inquire as to whether your finding is that the failure of the shank rod end was preceded by, and caused by, the bearing seizure. If so, what evidence is there to support the conclusion that the certification substantiation is invalid? If not, then what other components have you found were subjected to fatigue from vibratory stress?

In the circumstances of the subject accident, where the service loads may have been increased by a ball frozen in its housing, the action being assessed in response to A-79-53 above should constitute a reasonable engineering approach. The alternative would require, in essence, a recertification of this system in accordance with standards not yet established.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: June 27, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-53 and -54

Since July 1977, the National Transportation Safety Board has investigated two accidents involving Hiller UH-12EJ3 helicopters in which the mechanical flight control system malfunctioned. The first investigation revealed a fatigue failure in the shank area of a cyclic isolation link rod end bearing assembly. The metallurgical examination revealed that the failed rod end had a hollow shank. The total time on the cyclic isolation link (PN 3001-35) could not be determined, but the component has no retirement time. In the second accident the isolation link was not a causal factor; however, it was noted that the rod end had a hollow shank.

A review of manufacturing specifications indicated that hollow shank rod ends do not meet the design requirements for installation with cyclic isolation link PN 3001-35. Additional investigation revealed that the hollow shank rod ends could be obtained from various bearing supply houses and that they had the identical part number (HFP-RE-65) as the required solid shank ones. As a result of the above information, Hiller Aviation issued Service Letter 30-2, dated October 2, 1978, which recommended that all owners/operators (1) inspect their aircraft to verify that solid shank rod end assemblies were installed and (2) remove all hollow shank rod ends from the spare parts inventory.

The Safety Board is concerned that the Service Letter may not reach aircraft operators because of changes in aircraft ownership, leasing arrangements, and the remote

operating locations of these utility helicopters. In addition, since the turboshaft engine conversions now available will extend the useful life of these helicopters, the Safety Board believes that the FAA should establish a retirement time for those components of the mechanical flight control system which are subjected to constant vibratory stresses. The cyclic isolation link is one of these components.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive requiring compliance with Hiller Service Letter 30-2, dated October 2, 1978. (Class II--Priority Action) (A-79-53)

> Establish a retirement time for components of the UH-12 model helicopter's mechanical flight control system which are subjected to constant vibratory stresses. (Class II--Priority Action) (A-79-54)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and GOLDMAN, Members, concurred in the above recommendations.

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

MAY 22 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Thank you for your letter of April 29, 1981, further responding to National Transportation Safety Board Safety Recommendation A-79-70 issued September 6, 1979. We recommended that the Federal Aviation Administration (FAA) strictly enforce the compliance date for the installation of shoulder harnesses as required by 14 CFR 135.171.

We are pleased to learn that the air taxi operators who were granted extensions for the installation of shoulder harnesses are now in compliance with the new 14 CFR 135. This recommendation is now classified "Closed--Acceptable Action."

We thank the FAA for actions taken.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 29, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-79-68 through A-79-70 issued September 6, 1979, and supplements our letter of August 20, 1980. Recommendations A-79-68 and 69 have been classified in a "Closed--Acceptable Alternate Action" status by official Board action on September 12, 1980.

This letter responds to Safety Recommendation A-79-70, which was not addressed in our letter of August 20, 1980.

A-79-70. Strictly enforce the compliance date for the installation of shoulder harnesses as required by 14 CFR 135.171.

FAA Comment. On March 11, 1980, we forwarded to the Board a listing of air taxi operators (copy enclosed) that were granted extensions of the June 1, 1979, installation compliance date for shoulder harnesses, as set forth by 14 CFR 135.10. All requests for extension of the compliance date were necessitated because of nonavailability of shoulder harness kits by vendors or manufacturers prior to June 1, 1979.

The Federal Aviation Administration (FAA) recently conducted a nationwide spot check with several of our regions. Our findings reveal that the air taxi operators granted extensions are now in compliance with 14 CFR 135.10. Accordingly, the FAA considers action completed on Safety Recommendation A-79-70.

Sincerely

J. Lynn Helms
Administrator

Enclosure

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

2

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Please refer to National Transportation Safety Board Safety Recommendation A-79-70 issued September 6, 1979. We recommended that the Federal Aviation Administration (FAA) strictly enforce the compliance date for the installation of shoulder harnesses at aircrew positions as required by 14 CFR 135.171.

The new 14 CFR 135 which became effective December 1, 1978, specifies the installation of shoulder harnesses at flightcrew stations of commuter aircraft by June 1, 1979, with provisions for the granting of extensions to December 1, 1980.

The FAA's response of December 5, 1979, indicated that certain operators had been granted extensions because of a supply problem. In our followup letter of January 4, 1980, we requested further clarification. The date for the granting of extensions has now passed, and we would appreciate being informed of the status of this recommendation.

Sincerely yours,

James B. King

James B. King
Chairman

RECEIVED MAR 23 10 43 AM '81 OFFICE OF THE ADMINISTRATOR FEDERAL AVIATION ADMINISTRATION

AOA #: 249
ACTION: ASF-1
DUE DATE: 5/4/81
FOR SIGNATURE OF: AOA-1
COORDINATION WITH:
INFORMATION TO: AVS-1/AOA-1

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

March 11, 1980

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to your letter of January 4 requesting a summary of extensions granted by the Federal Aviation Administration (FAA) in relation to NTSB Safety Recommendation A-79-70. The recommendation called for strict enforcement of the compliance date for shoulder harness installation required by 14 CFR 135.171.

Enclosed is a listing of air taxi operators that were granted extensions of the June 1, 1979, installation compliance date for shoulder harness requirements which was required by 14 CFR 135.10. All requests for an extension of this date were required because of non-availability of shoulder harness kits by vendors or manufacturers prior to June 1, 1979. In three cases, requests were made after June 1, for reasons noted.

I trust that the above information and the enclosed listing of air taxi operators will fulfill the Board's request.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosure

Sent to AFO-1 on 1/7/80 3/11/80 -suspense

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

January 4, 1980

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

This is to acknowledge the Federal Aviation Administration's (FAA) letter of December 5, 1979, in response to the National Transportation Safety Board's safety recommendations A-79-68, 69, and 70 issued as a result of the Rocky Mountain Airlines DeHavilland DHC which crashed at Steamboat Springs, Colorado, on December 4, 1978.

The Safety Board recommended that the FAA amend 14 CFR 135 and 121 to require a survival training program for crewmembers that would include sea, desert, winter, and mountain survival (A-79-68); issue an Advisory Circular which outlines acceptable means of compliance with survival training requirements (A-79-69); and strictly enforce the compliance date for installation of shoulder harnesses as required by 14 CFR 135.171 (A-79-70).

The FAA's response to A-79-68 and 69 indicated agreement, in principle, with the need for crewmember survival training. We noted that rather than making a regulatory change, FAA plans to issue an Air Carrier Operations Bulletin (ACOB) within 90 days, which will require inspectors to assure that carriers include survival training, appropriate to route structure, in recurrent crewmember training. Since the ACOB will also include a suggested outline for a survival training program, we have classified the response to recommendations A-79-68 and 69 as "Open--Acceptable Alternate Action" until the bulletin is issued and reviewed by the Safety Board staff.

In response to A-79-70, which called for strict enforcement of the compliance date for shoulder harness installation required by 14 CFR 135.171, the FAA stated that compliance date extensions, beyond June 1, 1979, were logical in view of the supply problem and were not being abused. However, the response did not include any supporting information pertaining to the number of extensions being granted or the extent of the supply problem. We would appreciate receiving a summary of extensions

Requires reply by 2/15

granted by the FAA which shows the name of the operator; the date of the request; the reason for the request; the scheduled date of compliance; and in cases when the extension was requested after June 1, 1979, the reasons for late filing.

Until such information is made available for review, A-79-70 will be classified as "Open--Unacceptable Action."

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

December 5, 1979

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-79-68 through 70.

A-79-68. Amend 14 CFR 135.331 and 121.417 to require that each certificate holder provide a survival training program for its crewmembers that would include the basic information on sea, desert, winter, and mountain survival.

Comment. We do not believe that a regulatory amendment, as recommended, is appropriate at this time. We do agree, however, that crewmembers should be knowledgeable in survival techniques for the various environmental conditions that may be encountered following an air carrier accident.

To initiate training as soon as practical, we plan to issue an Air Carrier Operations Bulletin (ACOB), within the next 90 days, instructing our principal operations inspectors to have their assigned air carriers include survival training, as appropriate to the carrier's route structure, during the crewmembers' recurrent training.

A-79-69. Issue an Advisory Circular which outlines acceptable means of compliance with such a survival training program requirement.

Comment. As discussed in A-79-68 above, an Air Carrier Operations Bulletin instead of an Advisory Circular is more appropriate at this time. We plan to include a suggested outline for a survival training program in this Air Carrier Operations Bulletin.

A-79-70. Strictly enforce the compliance date for the installation of shoulder harnesses as required by 14 CFR 135.171.

Comment. This agency's action of granting certain operators extensions to the shoulder harness requirement under Part 135 is a logical solution to a supply problem. We are not aware of any abuses by operators in delaying the installation of shoulder harnesses in their aircraft.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: September 6, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-68 through -70

The National Transportation Safety Board's investigation of the Rocky Mountain Airlines DeHavilland DHC aircraft accident near Steamboat Springs, Colorado, on December 4, 1978, illustrated the immediate need for survival training for crewmembers and for the installation of shoulder harnesses on crew seats. 1/

Survival Training

The accident occurred in near-blizzard conditions about 1945 m.s.t. in mountainous terrain at the 10,500-ft. level. The first emergency rescue team arrived at the accident site about 10 hours later; the evacuation was completed 16 hours after the accident. Falling and blowing snow, strong winds, rugged terrain, darkness, and subfreezing temperatures hampered the search and rescue efforts.

There was a great potential for serious postcrash trauma, including hypothermia and frostbite. The aircraft occupants were extremely fortunate, however, to have among them a passenger trained in winter survival techniques, who acted promptly and appropriately and, with the few available resources, saved the lives of many of the passengers. Only 1 of the 20 passengers and 1 crewmember died as a result of this accident; 1 crewmember sustained minor frostbite.

1/ For more detailed information, read: "Aircraft Accident Report, Rocky Mountain Airways, Inc., DeHavilland DHC-6 Twin Otter, N25RM, near Steamboat Springs, Colorado, December 4, 1978." (NTSB-AAR-79-6).

2637B

A review of the Federal Aviation Regulations regarding crewmember emergency training revealed that crewmembers are required to be knowledgeable about methods and procedures to cope with in-flight emergencies, evacuations, and ditchings. However, this training does not extend to postcrash survival problems outside the aircraft. The actions taken by this passenger were the responsibility of the crewmembers. The Safety Board believes that appropriate training should be provided so that crewmembers can cope with these situations.

The Board learned that the FAA requires survival training for its own crewmembers as outlined in Section 261 of FAA Handbook 4040.9, "General Manual for Operation of FAA Aircraft." Courses are provided by the Civil Aeromedical Institute (CAMI). We believe that the existing information and programs could be adapted easily for commercial operators.

Shoulder Harnesses

The Board's investigation established that shoulder harnesses, if worn by the crewmembers, might have reduced their injuries.

The new 14 CFR 135, which became effective December 1, 1978, specifies the installation of shoulder harnesses at flightcrew stations of certain commuter aircraft by June 1, 1979, with provisions for the granting of extensions to December 1, 1980, to individual operators.

The Safety Board believes that the June 1 date allowed adequate time for most operators to comply. However, the Safety Board recognizes that a few operators had to develop Supplemental Type Certificates for certain older aircraft and that some operators have encountered supply problems beyond their control. In these few cases, extensions may be necessary, but it is inconceivable that many operators would require more than the initial 6 months of lead time for compliance. The Board believes that compliance with the requirements of 14 CFR 135.171 should be strictly enforced.

In view of the above, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend 14 CFR 135.331 and 121.417 to require that each certificate holder provide a survival training program for its crewmembers that would include the basic information on sea, desert, winter, and mountain survival. (Class II - Priority Action) A-79-68)

Issue an Advisory Circular which outlines acceptable means of compliance with such a survival training program requirement. (Class II - Priority Action) (A-79-69)

Strictly enforce the compliance date for the installation of shoulder harnesses as required by 14 CFR 135.171. (Class II - Priority Action) (A-79-70)

KING, Chairman, DRIVER, Vice Chairman, McADAMS and GOLDMAN, Members, concurred in these recommendations. BURSLEY, Member, did not participate.

James B. King

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

June 5, 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Thank you for your letter dated May 20, 1981, further responding to National Transportation Safety Board Safety Recommendations A-79-89 and -90 issued December 4, 1979. These recommendations stemmed from our investigation of engine malfunctions and failures related to fuel line vapor problems in Cessna 200-series aircraft.

We note that Cessna Airworthiness Directive (AD) 80-04-09 has not reduced the fuel vapor problem and that the Federal Aviation Administration (FAA) is continuing to work with the Cessna Corporation to effect a design change. We appreciate the FAA's offer to keep the Safety Board informed of any significant progress in the status of these recommendations.

Safety Recommendation A-79-89 is now classified in an "Open--Acceptable Action" status and A-79-90 in an "Open--Acceptable Alternate Action" status.

Sincerely yours,

James B. King
Chairman

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U.S. Department
of Transportation

Federal Aviation
Administration

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

May 20, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-79-89 and A-79-90 issued on December 4, 1979, and supplements our letter of March 3, 1980. This subject has been discussed by our respective staffs on a continuing basis, and was covered in detail at the February 12, 1981, FAA/NTSB quarterly meeting. This also responds to your letter of July 16, 1980.

A-79-89. Require the redesign of the Cessna 200-series aircraft fuel system to incorporate a separate means to route fuel vapor from the pump or reservoir to the fuel tanks, and require the retrofit of the new system on existing Cessna 200-series aircraft.

A-79-90. As an interim measure, issue an Airworthiness Directive to require the inspection of: (1) the forward fuel supply line for proper bend radius and tube diameter in the bend; and (2) the fuel lines inside the engine compartment for proper separation from exhaust system components or other heat sources of all Cessna-200 series airplanes, and the correction of all deficiencies found in those installations.

FAA Comment. Subsequent to the issuance of Airworthiness Directive (AD) 80-04-09, which is for insulation of fuel supply lines, 51 suspected and 13 confirmed reports of fuel vapor problems were evaluated by Cessna and the FAA Central Region Aircraft Certification Program Office. It is evident that AD 80-04-09 has not reduced the fuel vapor problem.

The FAA is continuing to work with Cessna Corporation to effect a design change to resolve this problem. We will keep the Board informed of our decision and any significant progress as our efforts continue in this area.

Sincerely,

J. Lynn Helms
Administrator

Office of
Chairman

National Transportation Safety Board
Washington, D.C. 20594

July 16, 1980

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

The Safety Board has reviewed your response of March 3, 1980, to our Safety Recommendations A-79-89 and A-79-90. We are pleased to note that Airworthiness Directive (AD) 80-04-09 was issued to correct the fuel line clearance problems and the excessive heat transfer to the fuel system of the 1976 through 1979 Cessna 210 model aircraft. This will no doubt correct one of the causes of fuel vapor problems in those aircraft.

In our view, your response only partially treats the second part of Recommendation A-79-90. The Board does not believe that AD 80-04-09 will eliminate all the causes of fuel vapor problems. The results of the fuel system tests conducted at Cessna on January 24, 1979, indicate that without a separate vapor return line, the system is vulnerable to vapor build-up, regardless of the fuel/vapor temperatures. This condition applies to all model 200-series aircraft.

We also note that the Chief of the Wichita Engineering and Manufacturing District Office advised Cessna by letter dated June 29, 1979, (copy enclosed) that the Federal Aviation Administration (FAA) considered the 200-series fuel system not to be in compliance with the Civil Air Regulations. Your staff stated that service experience, fuel system mockup tests, and flight tests demonstrated that an unsafe condition exists in the present fuel system design. Referenced letter also advised Cessna that a system design change was required. It further advised that the FAA intended to issue an AD requiring a retrofit of hardware changes which would correct this unsafe condition.

A subsequent FAA District Office letter, dated August 1, 1979, (copy enclosed) stated that fuel vapor would not readily pass through a line with numerous bends and low spots or level runs. This letter again advised Cessna of the need for a change in the fuel system design.

The Safety Board is aware that Cessna is continuing engineering work, involving flight tests, on the Cessna 200-series fuel vapor problem, since fuel vapor purging problems are still occurring with the modified 210 model aircraft. Moreover, the Cessna modification kit and AD 80-04-09 are directed only to 1976 and subsequent 210 model aircraft. Since the fuel systems and engines are virtually identical in Cessna 206/207 aircraft, those actions are not considered sufficient to correct this serious problem.

The Safety Board has reviewed the Cessna 200-series accident data for the years 1964 through 1978. During that time, there were 87 out of 440 engine failure accidents in which fuel starvation was cited as the probable cause of the engine failure. Because a fuel vapor problem is virtually impossible to detect after the fact, it is possible that many of the fuel starvation engine failures were the result of fuel vapor purging problems.

The Board remains extremely concerned about the vapor return problems of the Cessna 200-series airplanes, and urges that a redesign of the aircraft fuel system incorporate a separate means to route fuel vapor from the pump or reservoir to the fuel tanks. Meanwhile, we are maintaining Safety Recommendations A-79-89 and A-79-90 in an "Open--Unacceptable Action" status.

Sincerely yours,

for James B. King
Chairman

Enclosures

AUG 01 1979

Propulsion Unit
SD Project 9035

Fuel flow interruption problems on Cessna 206, 207, and 210 series airplanes

Chief, Wichita Engineering and Manufacturing District Office

Mr. Obed T. Wells, Executive Engineer
Cessna Aircraft Company
Pawnee Division
P.O. Box 1521
Wichita, KS 67201

During the meeting between Cessna Aircraft Company and Federal Aviation Administration (FAA) personnel in this office on July 23, 1979, Cessna provided a report, No. F-210D-3, "Fuel Injector Sump Tank Venting," and requested the FAA to provide comments. Our comments were given to Messrs. Hamilton and Burgess on July 27, 1979, and are confirmed in this letter as follows:

1. The report summary states that vapor will not readily pass through a line which has a low place or frequent bends, and that a one or two degree change in attitude is all that is necessary to stop vapor from going up a line that has a low or level place in the routing. We note that beginning with the 1967 model year, 210G/T210G and subsequent airplanes were extensively redesigned with a cantilever wing and an integral fuel cell replacing a bladder cell. The fuel venting system to the tank changed from a pitot type vent, which was the 1964 configuration of the report, to a wing trailing edge vent part. More importantly, a horizontally routed fuel line with multiple bends was installed from the doorpost fuel line to the finger strainers. This addition of approximately 18 inches of near level line with multiple bends is contrary to the findings in the summary of the report.

2. The report states that a 3/8" line permitted vapor to escape readily from the sump tank in the cruise configuration. The present fuel sump, when equipped with a 3/8" vapor return line routed to the wing tank expansion space in accordance with the recommendations in the report, should permit vapor from the sump tank to escape readily to the wing tank in all flight attitudes.

3. Our review of the report has not changed our finding that the present design does not comply with the applicable regulations.

AUG 1979

4. We are expecting Cessna to respond to the requested design changes, schedule for instructions and parts, and schedule for production incorporation per our letter of June 29, 1979.

BARRY D. CLEMENTS

43D:RABrenk:jhm:x6628:8/1/79

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

March 3, 1980

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-79-89 and A-79-90 issued by the Board on December 4, 1979. These recommendations resulted from the Board's investigation of engine malfunctions and failures related to fuel line vapor problems experienced in Cessna 200-series aircraft.

FAA's Central Region Engineering and Manufacturing Branch, working directly with Cessna Aircraft Company, has been aware of the facts cited by the Board in its December 4 transmittal letter and has been aggressively pursuing corrective action on this problem with the manufacturer.

The following are the FAA's comments and actions in response to these recommendations:

A-79-89. Require the redesign of the Cessna 200-series aircraft fuel system to incorporate a separate means to route fuel vapor from the pump or reservoir to the fuel tanks, and require the retrofit of the new system on existing Cessna 200-series aircraft.

Comment. Our service records document a vapor return problem on the 1976 through 1979 model year 200-series airplanes, but do not indicate a similar condition on the same models manufactured from 1964 through 1975 having the same vapor return provisions as the later airplanes. This forces us to conclude that the system design concept is not the dominant or pivotal factor in the vapor return problem.

The results of Cessna's flight tests of airplanes with temperature instrumented fuel systems verified by our engineers and flight test pilots, establish that, compared to 1964 through 1975 airplanes, there is an increase in the temperature of fuel/vapor returned to the reservoir tanks in the 1976 and subsequent airplanes. This increase is 9 to 11 degrees Fahrenheit and is sufficient to result in a significantly greater volume of vapor being returned from the engine to the fuel reservoir in these airplanes. This additional vapor, under other conditions conducive to vapor formation, exceeds the vapor handling capability of the system.

The manufacturer established, by a design review and comparison procedure, the design differences contributing to the returned fuel/vapor temperature increase, and then developed design changes to reduce this excessive heat transfer to the supply fuel and return fuel/vapor while it is in the engine compartment. The effectiveness of these changes was verified by flight testing. Basically, the changes add insulation to engine compartment fuel system components, and make some related line rerouting and support changes. The incorporation of these changes on the 1976 through 1979 airplanes lowers the fuel/vapor return temperature 15 degrees Fahrenheit and makes the fuel/vapor return system on these airplanes, from a vapor formation and handling standpoint, equivalent to the pre-1976 model year airplanes.

These modifications have already been incorporated in 1980 model year T210N and P210N airplanes. Cessna Service Kit SK-210-93, covered by Cessna Service Letter SE79-60, dated December 3, 1979 (copy enclosed), makes these modifications available for in-service airplanes. On February 8, 1980, FAA issued Airworthiness Directive 80-04-09 (copy enclosed) which requires these modifications on 1976 through 1979 Cessna Model T210M, T210N, and P210N airplanes.

A-79-90. As an interim measure, issue an airworthiness directive to require the inspection of: (1) the forward fuel supply line for proper bend radius and tube diameter in the bend; and (2) the fuel lines inside the engine compartment for proper separation from exhaust system components or other heat sources of all Cessna 200-series airplanes, and the correction of all deficiencies found in those installations.

Comment. Test results and service reports of which we are aware are inconclusive in establishing that minor system restrictions and tube diameter or bend radii discrepancies of the magnitude believed to exist in airplanes in service are significant factors in the vapor return problem. Our conclusion parallels the Board's statement in its transmittal letter that the findings from a test, accomplished with a full-scale fuel system mockup constructed by Cessna, determined that an undersize fitting was not the reason for the fuel problems addressed in Cessna Service Letter SE77-38, dated October 4, 1977. We conclude that at this time insufficient data or facts exist to credibly support a finding per Federal Aviation Regulation (FAR) 21.99 that the bend radii and tube diameter in the bend are unsafe conditions on in-service airplanes.

Additional fuel line support and increased clearance between engine compartment fuel lines and exhaust system components are provided by an additional bracket in 1980 model year and subsequent airplanes. The bracket is part of Cessna Service Kit SK-210-93 and is required with the installation of the insulation components by Airworthiness Directive 80-04-09.

We believe the preceding action will correct the deficiencies, which were the concern of NTSB Safety Recommendations A-79-89 and A-79-90, while incurring the least burden on the owner, operator, and the public.

Sincerely,

Langhorne Bond
Administrator

Enclosures

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: December 4, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-89 and -90

The National Transportation Safety Board has been investigating engine malfunctions and failures related to fuel line vapor problems in Cessna 200-series aircraft. The Federal Aviation Administration (FAA) Engineering and Manufacturing District Office (EMDO), which is responsible for oversight of Cessna Aircraft Company, and Cessna Aircraft Company personnel have been fully aware of our concern about this problem for some time. Cessna Aircraft Company recently issued service letters containing checklists and procedures on this subject to operators of Cessna 200-series aircraft. Additionally, the FAA issued an Airworthiness Directive (AD) 79-15-01, effective July 26, 1979, making the provisions of a portion of Cessna's service letters mandatory. Nevertheless, no action has been taken by Cessna or the FAA Central Region to institute hardware changes to correct this problem. The Safety Board is concerned about the lack of timely and adequate corrective action to eliminate fuel system problems that have been identified and believes that the FAA should take immediate action to eliminate the potentially unsafe condition on these aircraft.

The Safety Board's investigation of these Cessna 200-series aircraft engine malfunctions revealed that they frequently are caused by fuel vapor buildup in the aircraft and engine fuel system. Vapor generation in fuel systems is normal, but if it is not properly purged, or if vapor generation becomes excessive, fuel vapor will build up, restrict fuel flow, and may cause intermittent engine operation or complete loss of power. In some cases, the engine-driven fuel pump may cavitate, with an immediate total power loss.

The Safety Board became aware of fuel line vapor problems in the Cessna 200-series aircraft in April 1978, when one of its investigators experienced an engine malfunction while flying a 1974 turbocharged Cessna 210 (T-210). On two occasions, while level at 15,000 feet, the investigator noticed fuel

flow fluctuations and that the fuel flow dropped into the "red arc" 15 to 20 minutes after he switched from the right to left fuel tank. The investigator advanced the mixture to full rich, but there was no change in fuel flow indication, and actuation of the auxiliary fuel boost pump did not change the fuel flow indication appreciably. He noticed rough engine operation, and when he actuated the "maximum" electric fuel boost pump switch, the engine quit. After he released the "maximum" boost pump switch, the engine restarted and he made a safe landing. Apparently, the maximum boost pump purged the fuel vapor but "flooded" the engine.

At that time, the Safety Board believed that the problem with this aircraft was solved by compliance with Cessna Service Letter SE 77-38, dated October 4, 1977. SE 77-38 discussed symptoms similar to those experienced by the Safety Board's investigator. The letter stated that undersize fuel reservoir upper fittings had been installed in some Cessna 200-series aircraft and that the undersize fittings "may allow 'vapor buildup' in the fuel system by restricting purging of fuel vapor to the main tank." SE 77-38 recommended that, if certain fuel flow fluctuation symptoms were experienced, including "intermittent engine operation at altitude," the upper fittings should be inspected for proper size. If found undersize, the fuel reservoir should be replaced.

The left fuel reservoir upper fitting in the T-210 aircraft, in which the Safety Board's investigator encountered the engine problem, was inspected and found to be 0.016 inch undersize. The reservoir was replaced, and no further problems were reported with that aircraft. Review of Service Difficulty Reports and followup with Cessna and the Wichita EMDO revealed that there were several similar occurrences reported by operators which had led Cessna to issue SE 77-38.

During the Safety Board's investigation of a fatal Cessna T-206 accident in July 1978 in which an unexplained engine failure had occurred, we again became concerned about Cessna 200-series aircraft fuel system problems. Both fuel reservoir upper fittings in that aircraft were found to be considerably below specified tolerance. We concluded that fuel vapor buildup, as referenced in SE 77-38, may have caused the engine failure.

Because fuel vapor problems are extremely difficult to document and verify during an accident investigation, the Safety Board requested the Cessna Aircraft Company to test the fuel system in a full scale dynamic mockup of the Cessna 200-series aircraft. The purpose of the proposed test was to demonstrate and evaluate the mechanism of the suspected fuel vapor buildup and determine how the undersize fuel reservoir fittings caused problems.

A full scale fuel system mockup was constructed at Cessna Aircraft Company with various metering devices and transparent fuel supply lines and fuel reservoir. The mockup was considered by all parties to the investigation to be representative of the actual fuel system. The mockup was completed in January 1979, and numerous tests were accomplished in the presence of Safety Board, FAA, and Cessna personnel. Two findings were evidenced by manipulation of the mockup:

(1) During operation of the mockup to simulate various flight and power conditions, fuel vapor generated within the engine fuel system was returned to the reservoir via the engine-driven fuel pump vapor return line. The vapor collected in the upper neck of the reservoir and bubbled upward in the forward fuel supply line, located in the forward door posts, to the main tank, while fuel flowed down to the reservoir through both forward and aft lines, as designed. After an undersize fitting of the smallest dimension found in service was installed on the reservoir neck, vapor bubbles moved up the line to the tank. It was noted that a large bubble tended to hang at the top of the line in a bend where the line became horizontal to facilitate routing to the fuel cell. Apparently, the vapor bubbles lost their buoyancy as they were routed through the various bends and had to travel horizontally toward the fuel cell. Although the vapor bubbles seemed to lose energy en route to the fuel tank, they did in fact reach the tank and were vented overboard.

The findings of this portion of the test determined that an undersize fitting was not the reason for the fuel problems referenced in SE 77-38. When Cessna personnel were asked how they had previously determined that the undersized fittings were the reason for the problems, they replied that the fuel flow fluctuations and engine malfunctions reported by numerous pilots "suggested vapor buildup in the system." They said that undersize fittings were found in some aircraft and they, therefore, "concluded that the fittings were the reason." The Safety Board believes that the engineering evaluation, which was done to support SE 77-38, was inadequate and did not result in suitable corrective action for the reported problems.

(2) Since the reason for the reported fuel flow fluctuations and engine malfunctions had not been determined, further manipulation of the mockup was accomplished. After numerous tests, it was demonstrated that the mere act of switching the fuel tank selector from one tank to another could cause a condition in which fuel vapor was trapped in the reservoir and would eventually build up in the system between the reservoir and engine-driven fuel pump. This significantly reduced the fuel flow.

On certain occasions, when the fuel selector was switched, a surge of fuel started down the forward door post supply line. The fuel coming down the forward door post supply line was a solid column, flowing at the rate of demand required by the engine. The dynamics of the system in this condition were such that the column of fuel perpetuated itself in a "siphon-type" action. The aft supply line remained full of fuel, but no flow occurred. The flow of fuel down the forward supply line was sufficient to overcome the buoyancy of the fuel vapor bubbles and the vapor was trapped in the reservoir. Under these conditions, in 10 to 20 minutes, vapor nearly filled the reservoir and began to build up in the engine fuel system, and the fuel flow slowed. Symptoms of fuel flow fluctuations, similar to those experienced by the Safety Board's investigator and those reported by other pilots of this model aircraft, were evidenced on the metering devices of the mockup. This condition was induced and duplicated several times.

The findings of this portion of the test determined that vapor buildup problems in Cessna 200-series aircraft can be caused, in certain conditions, merely by the switching of fuel tanks. The symptoms occur approximately 10 to 20 minutes after switching fuel tanks. This condition will cause fuel flow fluctuations and may cause cavitation of the engine fuel pump with a subsequent loss of power. The Safety Board believes that the Cessna 200-series aircraft fuel system should be revised to prevent this problem.

The Safety Board is aware that many of the reported fuel flow fluctuation problems and unexplained engine failure/malfunctions in Cessna 200-series aircraft did not occur as a result of fuel tank switching. The Safety Board's investigation into this problem revealed that other design features of the fuel system and certain manufacturing practices can cause conditions conducive to fuel flow fluctuations and engine failure from vapor buildup in the system. Specifically, if excess heat is transmitted to the fuel system, considerable fuel vapor is generated within the system, and under certain conditions, fuel flow fluctuations and engine-driven fuel pump cavitation will occur. On certain turbocharged models, Cessna's manufacturing specifications require at least 1 inch clearance between the fuel line and the exhaust crossover pipe. However, several aircraft have been found, both in service and in production, with a clearance of less than 1 inch. Such proximity to a heat source can cause excessive fuel vaporization.

Routing and restrictions in the lines affect the purging of vapor when liquid is also present in the line. Vapor collects at high points in the line and at restrictions, such as tight bends with reduced tube diameter. During a recent investigation involving an engine failure in a new Cessna P-210, the Safety Board found that the forward fuel supply line from the tank in use had a bend with a radius of less than design specifications and a reduced tube diameter in the bend. In addition, the line was pitched downward between that bend and the fuel tank.

One positive means of eliminating vapor buildup in the aircraft and engine fuel systems is to route a separate vapor return line from the engine-driven fuel pump directly to the appropriate main fuel tank where the vapor will be vented overboard. The present design of the Cessna 200-series aircraft fuel system routes the vapor return line to the reservoir where the vapor must bubble in the forward fuel supply line to the tank. This design feature is not a positive means of venting vapor away and may not be in compliance with the intent of design certification provisions of Civil Air Regulation (CAR) 3.446 or Federal Aviation Regulation (FAR) 23.975 under which the Cessna 200-series aircraft were certificated. These regulations require that carburetors, 1/ which are provided with vapor elimination connections, be provided with a vent line which will lead vapors back to one of the aircraft's fuel tanks.

The Safety Board is aware that there is a difference of opinion between the FAA and Cessna regarding the compliance of the Cessna 200-series aircraft with CAR 3.446 and FAR 23.975. Nevertheless, the Safety Board believes that the Cessna 200-series aircraft fuel systems should be modified to prevent the

1/ "Carburetor" in this context has been interpreted by the FAA, for design certification purposes, to include fuel injection systems.

type of vapor problems evidenced. The vapor return line from the engine-driven fuel pump should be routed in a manner so as to provide positive vapor venting into the fuel tank. This is a typical practice in other fuel-injected general aviation aircraft, including twin-engine Cessna aircraft.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Require the redesign of the Cessna 200-series aircraft fuel system to incorporate a separate means to route fuel vapor from the pump or reservoir to the fuel tanks, and require the retrofit of the new system on existing Cessna 200-series aircraft. (Class II, Priority Action) (A-79-89)
>
> As an interim measure, issue an Airworthiness Directive to require the inspection of: (1) the forward fuel supply line for proper bend radius and tube diameter in the bend; and (2) the fuel lines inside the engine compartment for proper separation from exhaust system components or other heat sources of all Cessna 200-series airplanes, and the correction of all deficiencies found in those installations. (Class II, Priority Action) (A-79-90)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

US Department of Transportation
Federal Aviation Administration

Office of the Administrator

800 Independence Ave. S.W.
Washington, D.C. 20591

June 10, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-79-98 through A-79-105 issued December 21, 1979, and supplements our letter of March 20, 1980. This also responds to your letter of June 13, 1980, in which you expressed continued reservation in many areas of concern, and requested clarification and additional information. The subject recommendations resulted from the American Airlines DC-10 accident in Chicago on May 25, 1979. We offer the following comments regarding those safety recommendations which have been placed in an "Open--Unacceptable Action" status. These include Recommendations A-79-98, -99, -101, -102, and -103; and, our close-out comments on Recommendation A-79-105, which has been classified in an "Open--Acceptable Action" status. Our discussion includes a brief summary of previous NTSB comments. This format is intended to provide better continuity to the correspondence history relative to these recommendations. Information regarding Recommendations A-79-100 and -104, which have been classified in an "Open--Acceptable Action" status will be provided as we complete these actions.

A-79-98. Incorporate in type certification procedures full consideration of:

(a) Factors which affect maintainability, such as accessibility for inspection, positive or redundant retention of connecting hardware and the clearances of interconnecting parts in the design of critical structural elements; and

(b) Possible failure combinations which can result from primary structural damage in areas through which essential systems are routed.

NTSB Discussion.

The Federal Aviation Administration's (FAA) response indicated that current certification procedures include participation of maintenance personnel in areas of design affected by maintenance and that the FAA

intends to amend the procedures to include additional participation by maintenance specialists. While this stated intention may result in additional consideration of maintainability factors, the response is not specific regarding the methods which will assure that the factors cited in part (a) of this recommendation will be considered during design and certification. In response to part (b), which calls for consideration of failure combinations resulting from a primary structural failure, FAA cited several sections of the CFR which are related to combined failures. However, specific procedures to assure the consideration of combined system failures resulting from primary structural damage in areas where essential systems are routed were not cited.

In the case of this accident, the NTSB investigation indicated that the procedures used to demonstrate compliance with regulations were lacking in the areas cited in the recommendation; the regulations were not faulted. This recommendation was directed at the inclusion of specific considerations in certification and design procedures; however, the FAA reply only cited regulations rather than discussing the method in which they are applied.

NTSB requests clarification regarding the methods which will assure that the factors cited in this recommendation receive appropriate consideration during certification. An advisory circular (AC), similar to the recently issued draft AC 25.1309-X, "Airplane System Design Analysis," might provide the explicit guidance to assure proper consideration of maintainability factors and failure combinations during the aircraft certification process. Until a clarification is obtained, this recommendation has been placed in an "Open--Unacceptable Action" status.

FAA Comment.

As previously indicated FAA fully agrees with the Board's statement on the importance of emphasizing maintainability factors in the aircraft design phase. During our post-accident investigations we, too, sought to review the adequacy of our practices in this area. We found that our emphasis on the importance of maintainability considerations in the design stage has included mandatory participation of an appropriate maintenance specialist on the type certification board in accordance with FAA Order 8110.4, paragraph 13. Participation of maintenance specialists is further required, and their function enhanced, by terms of the latest version of Federal Aviation Regulations (FAR) 25.571, "Damage-tolerance and fatigue evaluation of structure," which requires consideration of all failure modes during the entire useful life of a structure. This particular regulation, and its implementation in practice, strongly emphasizes maintenance participation during the design review stage by requiring consideration of the service history of similar designs, development of inspection programs to show compliance with the rule, and development of a maintenance manual. The specific examples cited by the Board are also covered in the type certification process, as we indicated earlier, inasmuch as each is the subject of a specific certification regulation cited in previous correspondence. As a further check on the adequacy of maintenance work and procedures, the Aviation Standards Service Difficulty Reports, issued daily, are individually reviewed by appropriate engineering or maintenance personnel. In this way, oversights

of the certification process which may have occurred are brought promptly to the attention of FAA so that they might be expeditiously corrected. In summary, we believe that the recent amendment to FAR 25.571 and the requirement for a maintenance manual as set forth in 25.529, taken together with the mandatory participation of maintenance specialists in the type certification process, existing guidance material and service difficulty review practices provide full compliance with the intent of the Board's recommendation, and we plan no additional action on this recommendation.

A-79-99. Insure that the design of transport category aircraft provides positive protection against asymmetry of lift devices during critical phases of flight; or, if certification is based upon demonstrated controllability of the aircraft under condition of asymmetry, insure that asymmetric warning systems, stall warning systems, or other critical systems needed to provide the pilot with information essential to safe flight are completely redundant.

NTSB Discussion.

The response indicates that FAA believes the current regulations provide an adequate basis to protect against adverse consequences resulting from asymmetric deployment of lift devices. The reply does not directly address the redundancy recommendation for warning systems. Therefore, the Board concludes that the FAA does not agree that warning system redundancy for aircraft certificated on the basis of demonstrated controllability for lift device asymmetry is a necessary and desirable design feature.

In the case of the DC-10, the lack of warning system redundancy results in a situation in which position information for lift devices on both sides of the aircraft is not available to both (captain's and first officer's) Attitude and Thrust/Speed Command (AT/SC) computers. Therefore, a problem sensed on one side of the aircraft would only be apparent on one crewmember's instrumentation. The DC-10 was also certificated with only one stall warning stick shaker on the captain's control column which is powered from the No. 1 28 volt DC bus. As occurred in this accident, a failure of the No. 1 electrical system results in the loss of stall warning from the stick shaker and the loss of lift device configuration information from the left side of the aircraft because of a lack of warning system redundancy. If the aerodynamic warning of impending stall is masked (as occurred in this accident because the inboard leading edge slats remained extended), the crew no longer has information essential to safe flight.

The failure to discuss the merits of redundancy is puzzling in light of the McDonnell Douglas AD 79-15-05 (Amendment 39-3515) issued by the FAA. This AD, applicable to the DC-10, requires installation of a second AT/SC computer or modification of the stall warning system to handle additional inputs from angle of attack and slat position sensors.

The Board requests more specific information regarding the reasons for not including redundancy of warning systems in procedures used to certificate aircraft for lift device asymmetry on the basis of controllability. This recommendation is classified "Open--Unacceptable Action."

FAA Comment.

During FAA post-accident studies, the questions articulated by the Board were reviewed with regard to the DC-10 stall warning and associated systems. As the Board pointed out, an analysis of the detailed circumstances leading to this accident did show that, in the specific case of the DC-10, additional redundancy might be appropriate. However, Airworthiness Directive (AD) 79-15-05 (Amendment 39-3515) cited by the Board did not call for added redundancy, which was instead the subject of AD 80-03-10 (Amendment 39-3673). As the Board requests, more specific discussion of this point follows.

As a matter of long standing policy, FAA attempts to specify performance standards, rather than lay down step-by-step compliance requirements, to achieve a safety objective. Thus, for example, redundancy is generally not mandated when discussing general design requirements, as in the case of FAR 25.671 (which covers general aircraft control system requirements) or FAR 25.1309 (which covers general equipment, systems and installation requirements) discussed in previous correspondence. Instead, a thorough and complete analysis of failure modes and the resulting effects on flight safety is required, and minimum levels of safety are specified. System redundancy is one means to achieve that specified level of safety, but other methods are also available (different designs or higher system reliability are two examples). In the specific case of the DC-10 accident, redundancy alone would not have broken the cause-effect chain. The mandatory compliance item cited by the Board--AD-79-1505--called for either rewiring of a single auto throttle/speed control (AT/SC) computer, or installation of a dual computer system with each one similarly rewired. The objective of this directive was to modify the AT/SC computers in two ways: first, so they would act on signals from both the left- and right-wing angle-of-attack and outboard wing slat groups; second, so they would conservatively respond to the absence of sensor input--for example, by activating slat-retracted stall speed commands when signal is lost from one outboard slat position sensor on takeoff. This AD is an excellent example of employing an alternative to redundancy, in coordination with a risk analysis, to achieve an appropriation level of safety. (See, in addition, "Estimating the Probability of Asymmetric Deployment of the Leading Edge Slat System on the DC-10 Aircraft," Technical Report No. 79-1365, J. H. Wiggins Company, Redondo Beach, California.) Our full analysis of this situation, however, in conjunction with public comment received on our proposal of AD 80-03-10, lead us to conclude that the demonstrated failure mode of the DC-10 required, in addition, stick shaker and AT/SC computer redundancy, which was then mandated. This later action was designed to address the entire present and future DC-10 fleet, throughout its useful life, in contrast to the short-term (say, 1 year) horizon used in developing AD 79-15-05. In summary, we believe that a blanket requirement for redundancy could place a burden on manufacturers and operators which, in some cases, may not be counterbalanced adequately by a safety benefit of commensurate worth. Our review of the regulations which deal with this aspect of aircraft design has found them to be appropriate, in that they require the same results as the Board's recommendation would achieve, but in some cases permit somewhat greater flexibility in achieving those ends. Accordingly, we believe the intent of the Board's recommendation has been met, and we plan no additional action.

A-79-101. Assure that the Maintenance Review Board fully considers the following elements when it approves an Airline/Manufacturer Maintenance Program:

(a) Hazard analysis of maintenance procedures which involve removal, installation, or work in the vicinity of structurally significant components in order to identify and eliminate the risk of damage to those components;

(b) Special inspections of structurally significant components following maintenance affecting those components; and

(c) The appropriateness of permitting "on condition" maintenance and, in particular, the validity of sampling inspection as it relates to the detection of damage which could result from undetected flaws or damage to structurally significant elements during manufacture or maintenance.

NTSB Discussion.

FAA's reply explained that the responsibility for maintenance procedure adequacy resides with the individual air carrier and repair stations, and FAA surveillance is provided by inspectors assigned to the carrier.

It is precisely this method of allowing the carriers and repair stations to determine the adequacy of their own maintenance procedures, which includes conducting an appropriate hazard analysis and assisting inspection procedure suitability, that led to the implementation of the variant procedure used for spherical bearing changes. This procedure was implemented by American Airlines without an FAA review of the procedural details.

The intent of the recommendation was to assure that a hazard analysis of maintenance procedures for new aircraft would be prepared by the manufacturer and carefully reviewed by FAA prior to implementation by operators. This could be accomplished in a manner similar to the certification procedure used in approval of failure analyses required for aircraft systems. If the Maintenance Review Board (MRB) is not the proper forum for accomplishing such a task, then the Board would willingly accede to an alternative method which provided equivalent assurance of a careful review. With FAA review of manufacturer-recommended maintenance procedures as a basis, the FAA air carrier inspector would only be responsible for reviewing variations from the manufacturer's procedures.

In reply to item (c), the FAA agreed to include the appropriateness of "on condition" and sampling inspections for structurally significant items as an agenda item for the Maintenance Steering Group meeting. In remarks regarding item (c), the FAA stated that a means by which the MRB could forecast the Structurally Significant Items (SSI's), which might be vulnerable to maintenance damage or manufacturing defects, could not be envisioned. This position strengthens the case for hazard analysis of certain SSI-related maintenance procedures in certification activities. A

review of manufacturer-developed procedures involving removal, installation, or work in the vicinity of SSI's could provide the ability to forecast which SSI's are vulnerable to maintenance-induced damage and to prescribe the suitable method and interval of inspection. This recommendation has been classified as "Open--Unacceptable Action" until the Board receives an FAA response regarding alternative MRB review of hazard analyses.

A-79-102. Require that air carrier maintenance facilities and other designated repair stations:

(a) Make a hazard analysis evaluation of proposed maintenance procedures which deviate from those in the manufacturer's maintenance manual and which involve removal, installation, or work in the vicinity of structurally significant components; and

(b) Submit proposed procedures and analysis to the appropriate representative of the Administrator, FAA, for approval.

NTSB Discussion.

FAA's response states that the responsibility for maintenance procedures resides with the air carrier and repair stations. This includes the responsibility to assure the adequacy of maintenance programs and procedural changes. It was this type of cursory surveillance activity which allowed the variant spherical bearing replacement procedure to be practiced by air carriers. This safety recommendation is intended to assure a proper review of maintenance procedures differing from those developed by the manufacturer for removal, installation, or work in the vicinity of structurally significant items. This recommendation has been classified as "Open--Unacceptable Action." The Board requests reconsideration of this recommendation to intensify surveillance and review functions for SSI-related maintenance procedures varying from manufacturer recommendations.

FAA Comment.

These recommendations and your discussion of our response imply a belief by the Board that the transport aircraft manufacturers are the most knowledgeable source on how to maintain the aircraft; and, that any operator's deviation from the manufacturers' guidance should be subjected to an extensive hazard analysis prior to FAA approval. We do not agree. It has been our observation that the air carriers, because of operational experience not held by the manufacturers, actually know more about how to maintain their aircraft than do the manufacturers. At the outset, the manufacturers' knowledge may be greater in what maintenance tasks should be done, but not in how they can best be accomplished. We also point out that ultimate responsibility for proper maintenance in the case of air carriers is levied by statute on the operator, not the manufacturer. This is not to say that the manufacturer is not knowledgeable in maintenance; that they should not be or are not intimately involved in analyzing maintenance problems, suggesting maintenance procedures, devising repairs, and developing means to eliminate recurrence of problems. Indeed, they are heavily involved in these activities on a continuing basis, in partnership

with the air carriers, under FAA surveillance. The manufacturers and air carriers presently work together very closely before a new aircraft design enters service under the guidance of industry "Maintenance Steering Group" (MSG) procedures to define the appropriate initial maintenance program for new aircraft. Technical working groups are formed. Much of the same technical data, including the same failure analyses that are submitted by the manufacturers for type certification purposes, are also used by the technical working groups under MSG procedures. FAA specialists participate with the various MSG bodies to begin their assessment of the total maintenance program being developed which in turn must be approved by the FAA Maintenance Review Board.

The manufacturers are also required to develop a maintenance manual which typically contains maintenance procedures. It has been our observation that air carrier industry (potential customers in particular) inputs have a significant influence over the content of these procedures. The air carriers are free to adopt alternative procedures consistent with their own operational situation and are responsible, by statute, for the safety of the procedures adopted. The Board stated that "It is precisely this method of allowing the carriers and repair stations to determine the adequacy of their own procedures . . . that led to the implementation of the variant procedures used for spherical bearing changes."

With the benefit of hindsight, we would certainly not now defend or allow a continuation of the procedures used by American Airlines to remove the engine and pylon as a single unit from the wing of the airplane to change the bearing. However, as was noted at your public hearing in Chicago on this accident, American Airlines maintenance personnel did not follow the company procedures. The numbered step-by-step tasks listed on the work card were accomplished out of sequence. Had the procedural sequence as defined on the work card been followed, the last action in removing the engine and pylon assembly would have been to remove the bolt at the aft pylon bulkhead attachment, and the first action in reinstallation would have been to replace the bolt at the aft pylon bulkhead attachment. This would have protected the fitting that was damaged. Instead, as we understand it, this bolt was removed earlier than specified leaving the pylon fittings free to strike the wing fitting while other tasks were being accomplished. In our opinion, had the defined sequence been followed, the damage that ultimately led to the accident probably would not have occurred. Even if it had occurred, it could have only occurred when the bolt was removed at the last task, and any impact that could have caused damage certainly would have been noted by the mechanic removing the bolt, at that time. The consequences would have been economic, i.e., the cost to repair the damage, rather than the resulting accident, would have been the issue under consideration. Accordingly, we question the assumption that a hazard analysis, conducted without the hindsight of this specific accident, would have rejected this written procedure, had it been subjected to a hazard analysis as you recommended.

To summarize, we do not agree that the manufacturers' maintenance procedural recommendations necessarily provide the best base against which to judge deviations by the air carriers; that the current industry MSG and FAA MRB procedures, involving the FAA, the manufacturer, and the operator, are inadequate; and, we believe the fact that established procedures were not followed was a significant factor in this accident, perhaps more than the procedure itself.

FAA Order 1800.12D, Program Guidelines, for FAA inspectors, has been reviewed to add the following emphasis item for air carrier maintenance surveillance:

"Maintenance performance. Conduct spot inspections of maintenance operations to ensure compliance with methods, techniques and practices specified by the operators' manuals and with engineering orders concerning modifications and repairs. Monitor the supervision of production and inspection personnel with regard to adequate coverage for proper accomplishment of work and level of inspection participation in relation to assuring proper maintenance accomplishment."

Based on the foregoing comments, the FAA considers action completed on Safety Recommendations A-79-101 and A-79-102.

A-79-103. Revise 14 CFR 121.707 to more clearly define "major" and "minor" repair categories to insure that the reporting requirement will include any repair of damage to a component identified as "structurally significant."

NTSB Discussion.

FAA's response indicated that a regulatory revision was not needed to clarify the definition of major and minor repair; however, an advisory circular is being prepared to emphasize the current regulation. This action could be considered as an acceptable alternative to the recommendation if the AC specifies that repairs to SSI's, as defined by the MRB, should be considered as major repairs. The Board requests information with regard to the treatment of SSI's in the proposed AC. The recommendation will be classified as "Open--Unacceptable Alternate Action" until the Board receives the information.

FAA Comment. The new advisory circular referred to above will incorporate the substance of this recommendation.

A-79-105. Revise operational procedures and instrumentation to increase stall margin during secondary emergencies by:

(a) Evaluating the takeoff-climb airspeed schedules prescribed for an engine failure to determine whether a continued climb at speeds attained in excess of V_2, up to V_2 + 10 knots, is an acceptable means of increasing stall margin without significantly degrading obstacle clearance;

(b) Amending applicable regulations and approved flight manuals to prescribe optimum takeoff-climb airspeed schedules; and

(c) Evaluating and modifying as necessary the logic of flight director systems to insure that pitch commands in the takeoff and go-around modes correspond to optimum airspeed schedules as determined by (a) and (b) above.

NTSB Discussion.

Since FAA's response indicates positive action has been taken regarding this recommendation, the Board has classified the recommendation as "Open--Acceptable Action." It is requested that NTSB be advised of progress regarding the regional review of the merits of increasing the stall margin for air carrier turbojet aircraft by maintaining whatever speed has been attained between V_2 and V_2 + 10 knots at the time of an engine failure.

The Board would also appreciate receiving any information related to procedural changes in aircraft flight manuals or to revisions in training and checking procedures resulting from the regional reviews, or any information regarding flight director changes resulting from consideration of logic modification by the Flight Standardization Policy Board.

FAA Comment.

The FAA has completed an evaluation of a representative sample of current jet transport aircraft to determine if NTSB Recommendation A-79-105 could be applied as a general policy for all aircraft. A conclusion reached was that the recommendation may be applicable to some aircraft; however, a general policy applicable to all aircraft is not possible. It was therefore concluded that the characteristics of individual aircraft models and configurations must be evaluated to determine whether a climb speed, as recommended by NTSB, is appropriate.

Accordingly, the FAA regions have been requested to review the performance characteristics of the transport category aircraft for which they have certification responsibility to determine whether it is appropriate to recommend maintaining an airspeed above V_2, but not greater than the all-engine climb speed, if a loss of thrust is encountered after V_2. Such a recommendation is appropriate if it can be shown that the flightpath at the higher speed lies above that based on scheduled V_2 speed. If appropriate, the information should be included in the FAA-approved Airplane Flight Manual as a recommended flight procedure.

On May 14 and 15, 1980, the FAA Office of Flight Operations held a Flight Standardization Board (FSB) general policy meeting to discuss the training, check procedures, and operating manual aspects of the NTSB recommendation. The following Board conclusions are relevant:

1. It was concluded that V_2 speeds are safe, but that Airplane Flight Manual guidance on permissive deviations from V_2 as recommended by the NTSB may be required to assure proper operational procedures and training.

2. The FSB agreed to reiterate the following standardized policy with regard to operational use of V_2 speed, subject to any variations resulting from regional reviews:

a. If the engine fails between V_1 and V_2, the pilot should increase to, and maintain, V_2 until obstacle clearance altitude is attained.

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b. If an engine fails between V_2 and V_2 + 10, the pilot may maintain the airspeed attained at the time of engine failure to obstacle clearance altitude.

c. If an engine fails above V_2 + 10, the pilot should reduce speed to V_2 + 10 and maintain V_2 + 10 until obstacle clearance altitude is attained.

3. Any recommended changes in aircraft flight manuals and revisions to training and checking procedures, which may result from regional reviews, will be evaluated at a general policy meeting of the FSB for further action.

4. Logic modification of current narrow-body air carrier aircraft flight directors appears to be highly complex, impractical, and probably unjustified. Current wide-body aircraft are programmed to provide V_2 pitch commands. As a general rule, the FSB considered it unnecessary to modify the V_2 to a greater speed. The FSB was advised that future air carrier aircraft (B-757, B-767, DC-9-80) will probably have the capability to program variable speeds up to V_2 + 10 in the event of an engine failure during takeoff. It was the consensus of the FSB that regardless of flight director commands, pilots have been, and should continue to be, trained to cross-check indicated airspeed as the primary indication of performance, rather than computed flight director data when coping with an engine failure. The FSB recommended that in conjunction with the regional reviews, Airplane Flight Manual information regarding the speeds scheduled by flight director takeoff mode should also be reviewed to assure that adequate information is presented to allow the crew to properly use the system. The relationship of the speed commanded by the system relative to scheduled V_2 speeds and appropriate use of the flight director in the case of engine failure should be considered.

5. The FSB rejected the concept that computer flight director data should present optimum takeoff-climb airspeed schedules in the event of secondary emergencies. The need to compute such information for flight director displays, considering the variables associated with a given takeoff, is not readily apparent.

It was also agreed that amending applicable regulations and approved flight manuals to prescribe optimum takeoff-climb airspeed schedules for use during secondary emergencies would probably be counterproductive. Optimum airspeed schedules would, of necessity, be extensive because of the many variables associated with takeoff conditions, coupled with the multitude of possible secondary emergencies. Reference to such a schedule during an emergency would divert crew attention at a critical time. Under such circumstances, what is needed is a <u>safe</u> airspeed, V_2; not an optimum airspeed.

We believe FAA actions as described in the foregoing accounts are reasonable, productive, and in the best interests of aviation safety. We are confident that these measures will correct the deficiencies which were of concern to the NTSB, while imposing no unnecessary burden on the owner, operator, or the public.

Sincerely,

J. Lynn Helms
Administrator

Office of
Chairman

National Transportation Safety Board

Washington, D.C. 20594

JUN 13 1980

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of March 20, 1980, in reply to National Transportation Safety Board Safety Recommendations A-79-98 through A-79-105 issued on December 21, 1979. These recommendations were based on the information obtained during the extensive investigation of the American Airlines DC-10 accident which occurred in Chicago, Illinois, on May 25, 1979.

After carefully considering this letter of response, we continue to have reservations regarding many areas of concern addressed by our recommendations. In some instances, we have proposed alternatives to accomplish the intended purpose of the initial recommendation; in other cases, we have requested clarification or additional information. The response to each recommendation is discussed separately, as follows:

A-79-98

Incorporate in type certification procedures full consideration of:

(a) Factors which affect maintainability, such as accessibility for inspection, positive or redundant retention of connecting hardware and the clearances of interconnecting parts in the design of critical structural elements; and

(b) Possible failure combinations which can result from primary structural damage in areas through which essential systems are routed.

Discussion

Your response indicated that current certification procedures include participation of maintenance personnel in areas of design affected by maintenance and that FAA intends to amend the procedures to include additional participation by maintenance specialists. While this stated intention may result in additional consideration of maintainability factors, the response is not specific regarding the methods which will assure that the factors cited in part (a) of this recommendation will be considered during design and certification. In response to part (b), which calls for consideration of failure combinations resulting from a primary structural failure, you cited several sections of the CFR which are related to combined failures. However, specific procedures to assure the consideration of combined system failures resulting from primary structural damage in areas where essential systems are routed were not cited.

In the case of this accident, the NTSB investigation indicated that the procedures used to demonstrate compliance with regulations were lacking in the areas cited in the recommendation; the regulations were not faulted. This recommendation was directed at the inclusion of specific considerations in certification and design procedures; however, the reply only cites regulations rather than discussing the method in which they are applied.

We would appreciate clarification regarding the methods which will assure that the factors cited in this recommendation receive appropriate consideration during certification. An Advisory Circular, similar to the recently issued draft AC 25.1309-X, "Airplane System Design Analysis," might provide the explicit guidance to assure proper consideration of maintainability factors and failure combinations during the aircraft certification process. Until a clarification is obtained, this recommendation will be placed in an "open--unacceptable action" status.

A-79-99

Insure that the design of transport category aircraft provides positive protection against asymmetry of lift devices during critical phases of flight; or, if certification is based upon demonstrated controllability of the aircraft under condition of asymmetry, insure that asymmetric warning systems, stall warning systems, or other critical systems needed to provide the pilot with information essential to safe flight are completely redundant.

Discussion

The response indicates that FAA believes the current regulations provide an adequate basis to protect against adverse consequences resulting from asymmetric deployment of lift devices. The reply does not directly address the redundancy recommendation for warning systems. Therefore, we must conclude that the FAA does not agree that warning system redundancy for aircraft certificated on the basis of demonstrated controllability for lift device asymmetry is a necessary and desirable design feature.

In the case of the DC-10, the lack of warning system redundancy results in a situation in which position information for lift devices on both sides of the aircraft is not available to both (captain's and first officer's) AT/SC computers. Therefore, a problem sensed on one side of the aircraft would only be apparent on one crewmember's instrumentation. The DC-10 was also certificated with only one stall warning stick shaker on the captain's control column which is powered from the No. 1 28 volt DC bus. As occurred in this accident, a failure of the No. 1 electrical system results in the loss of stall warning from the stick shaker and the loss of lift device configuration information from the left side of the aircraft because of a lack of warning system redundancy. If the aerodynamic warning of impending stall is masked (as occurred in this accident because the inboard leading edge slats remained extended), the crew no longer has information essential to safe flight.

The failure to discuss the merits of redundancy is puzzling in light of the McDonnell Douglas Airworthiness Directive 79-15-05 (Amendment 39-3515) issued by FAA. This AD, applicable to the DC-10, requires installation of a second AT/SC computer or modification of the stall warning system to handle additional inputs from angle of attack and slat position sensors.

We would appreciate more specific information regarding the reasons for not including redundancy of warning systems in procedures used to certificate aircraft for lift device asymmetry on the basis of controllability. This recommendation is classified "open--unacceptable action."

A-79-100

Initiate and continue strict and comprehensive surveillance efforts in the following areas:

(a) Manufacturer's quality control programs to assure full compliance with approved manufacturing and process specifications; and

(b) Manufacturer's service difficulty and service information collection and dissemination systems to assure that all reported service problems are properly analyzed and disseminated to users of the equipment, and that appropriate and timely corrective actions are effected. This program should include full review and specific FAA approval of service bulletins which may affect safety of flight.

Discussion

The measures outlined in your response to initiate and continue surveillance in the recommended areas were positive and comprehensive. This recommendation will be classified "open--acceptable action" until the regulatory revisions concerning service difficulty reporting and procedural revisions for manufacturer service document approval are evaluated by our staff.

A-79-101

Assure that the Maintenance Review Board fully considers the following elements when it approves an Airline/Manufacturer Maintenance Program:

(a) Hazard analysis of maintenance procedures which involve removal, installation, or work in the vicinity of structurally significant components in order to identify and eliminate the risk of damage to those components;

(b) Special inspections of structurally significant components following maintenance affecting these components; and

(c) The appropriateness of permitting "on condition" maintenance and, in particular, the validity of sampling inspection as it relates to the detection of damage which could result from undetected flaws or damage to structurally significant elements during manufacture or maintenance.

Discussion

Your reply explained that the responsibility for maintenance procedure adequacy resides with the individual air carrier and repair stations, and FAA surveillance is provided by inspectors assigned to the carrier.

It is precisely this method of allowing the carriers and repair stations to determine the adequacy of their own maintenance procedures, which includes conducting an appropriate hazard analysis and assessing inspection procedure suitability, that led to the implementation of the variant procedure used for spherical bearing changes. This procedure was implemented at American Airlines without an FAA review of the procedural details.

The intent of the recommendation was to assure that a hazard analysis of maintenance procedures for new aircraft is prepared by the manufacturer and carefully reviewed by FAA prior to implementation by operators. This could be accomplished in a manner similar to the certification procedure used in approval of failure analyses required for aircraft systems. If the MRB is not the proper forum for accomplishing such a task, then we would willingly accede to an alternative method which provided equivalent assurance of a careful review. With FAA review of manufacturer-recommended maintenance procedures as a basis, the FAA air carrier inspector would only be responsible for reviewing variations from the manufacturer's procedures. In reply to item (c) you agreed to include the appropriateness of "on condition" and sampling inspections for structurally significant items as an agenda item for the Maintenance Steering Group meeting. In remarks regarding item (c) you stated that a means by which the MRB could forecast the SSI's which might be vulnerable to maintenance damage or manufacturing defects could not be envisioned. This position strengthens the case for hazard analysis of certain SSI-related maintenance procedures in certification activities. A review of manufacturer developed procedures involving removal, installation, or work in the vicinity of SSI's could provide the ability to forecast which SSI's are vulnerable to maintenance-induced damage and to prescribe the suitable method and interval of inspection. This recommendation has been classified as "open--unacceptable action" until we hear from you regarding alternatives to MRB review of hazard analyses.

<u>A-79-102</u>

Require that air carrier maintenance facilities and other designated repair stations:

(a) Make a hazard analysis evaluation of proposed maintenance procedures which deviate from those in the manufacturer's maintenance manual and which involve removal, installation, or work in the vicinity of structurally significant components; and

(b) Submit proposed procedures and analysis to the appropriate representative of the Administrator, FAA, for approval.

Discussion

Your response states that the responsibility for maintenance procedures resides with the air carrier and repair stations. This includes the responsibility to assure the adequacy of maintenance programs and procedural changes. It was this type of cursory surveillance activity which allowed the variant spherical bearing replacement procedure to be practiced by air carriers. This safety recommendation is intended to assure a proper review of maintenance procedures differing from those developed by the manufacturer for removal, installation, or work in the vicinity of structurally significant items. This recommendation has been classified as "open--unacceptable action." We request reconsideration of this recommendation to intensify surveillance and review functions for SSI-related maintenance procedures varying from manufacturer recommendations.

A-79-103

Revise 14 CFR 121.707 to more clearly define "major" and "minor" repair categories to insure that the reporting requirement will include any repair of damage to a component identified as "structurally significant."

Discussion

Your response indicated that a regulatory revision was not needed to clarify the definition of major and minor repair; however, an Advisory Circular (AC) is being prepared to emphasize the current regulation. This action could be considered as an acceptable alternative to the recommendation if the AC specifies that repairs to structurally significant items (SSI's), as defined by the MRB, should be considered as major repairs. We request information with regard to the treatment of SSI's in the proposed AC. The recommendation will be classified as "open--acceptable alternate action" until we receive the information.

A-79-104

Expand the scope of surveillance of air carrier maintenance by:

(a) Revising 14 CFR 121 to require that operators investigate and report to a representative of the Administrator the circumstances of any incident wherein damage is inflicted

upon a component identified as "structurally significant" regardless of the phase of flight, ground operation, or maintenance in which the incident occurred; and

(b) Requiring that damage reports be evaluated by appropriate FAA personnel to determine whether the damage cause is indicative of an unsafe practice and assuring that proper actions are taken to disseminate relevant safety information to other operators and maintenance facilities.

Discussion

We appreciate your acceptance of this recommendation; however, we do have the following reservation: Although the scope of the mechanical reliability reports would be expanded by the proposed regulatory revision to include maintenance-induced damage, the response does not indicate the manner in which structurally significant items, as defined by the Maintenance Review Board, will be treated. We believe the SSI's should be included in the expanded mechanical reliability reports as indicated by recommendation A-79-103. We have classified this recommendation as "open—acceptable action" until a clarification is received regarding the content of the Advisory Circular proposed by FAA in reply to A-79-103.

A-79-105

Revise operational procedures and instrumentation to increase stall margin during secondary emergencies by:

(a) Evaluating the takeoff-climb airspeed schedules prescribed for an engine failure to determine whether a continued climb at speeds attained in excess of V_2, up to V_2 + 10 knots, is an acceptable means of increasing stall margin without significantly degrading obstacle clearance.

(b) Amending applicable regulations and approved flight manuals to prescribe optimum takeoff-climb airspeed schedules; and

(c) Evaluating and modifying as necessary the logic of flight director systems to insure that pitch commands in the takeoff and go-around modes correspond to optimum airspeed schedules as determined by (a) and (b) above.

Discussion

Since your response indicates positive action has been taken regarding this recommendation, we have classified the recommendation as "open--acceptable action." We request that we be advised of progress regarding the regional review of the merits of increasing the stall margin for air carrier turbojet aircraft by maintaining whatever speed has been attained between V_2 and V_2 + 10 knots at the time of an engine failure.

We would also appreciate receiving any information related to procedural changes in aircraft flight manuals or to revisions in training and checking procedures resulting from the regional reviews, or any information regarding flight director changes resulting from consideration of logic modification by the Flight Standardization Policy Board.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

March 20, 1980

Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-79-98 through 105 issued on December 21, 1979, based on the Board's determination of probable cause and final report on the American Airlines DC-10 accident in Chicago on May 25, 1979. The Board expressed concern about possible aircraft design and certification deficiencies, and possible deficiencies in the manufacturing and quality control processes of a major airframe manufacturer. Major maintenance procedures, surveillance, and operations procedures were identified by the Board as areas of concern. The following are the Federal Aviation Administration's (FAA) comments and actions in response to these recommendations:

A-79-98

Incorporate in type certification procedures full consideration of:

(a) Factors which affect maintainability, such as accessibility for inspection, positive or redundant retention of connecting hardware and the clearances of interconnecting parts in the design of critical structural elements; and

(b) Possible failure combinations which can result from primary structural damage in areas through which essential systems are routed.

COMMENT A-79-98:

Our current type certification procedures include maintenance participation in assessing all areas of the design which are affected by maintenance. We intend to further amend these procedures to assure and emphasize that maintenance specialists, including our National Resource Specialists, will participate in approval of all features of a design which involve maintenance concerns.

COMMENT A-79-98(a):

With regard to maintainability, FAR 25.611 covers the factor of accessibility; FAR 25.607(a) and (b) cover the factor of retention of connecting hardware; and FAR 25.601 and 25.571 cover clearances of interconnecting parts in the design of critical structural elements.

COMMENT A-79-98(b):

Design aspects of failure combinations which can result from primary structural damage in areas through which essential systems are routed are covered by FAR 25.571, 25.601, 25.671, and 25.1309.

A-79-99

Insure that the design of transport category aircraft provides positive protection against asymmetry of lift devices during critical phases of flight; or, if certification is based upon demonstrated controllability of the aircraft under condition of asymmetry, insure that asymmetric warning systems, stall warning systems, or other critical systems needed to provide the pilot with information essential to safe flight are completely redundant.

COMMENT:

Current regulations contain a firm basis to assure positive protection against asymmetry of lift devices during critical phases of flight or the demonstration of adequate warning and controllability of the aircraft during conditions of asymmetry. FAR 25.671, as amended by Amendment 25-23 on April 8, 1970, requires demonstration of continued safe flight and landing after any combination of failures not shown to be extremely improbable. FAR 25.1309 presently requires that all information essential to continued safe flight and landing be provided to the pilot in all cases of failures not shown to be extremely improbable.

A-79-100

Initiate and continue strict and comprehensive surveillance efforts in the following areas:

(a) Manufacturer's quality control programs to assure full compliance with approved manufacturing and process specifications; and

(b) Manufacturer's service difficulty and service information collection and dissemination systems to assure that all reported service problems are properly analyzed and disseminated to users of the equipment, and that apropriate and timely corrective actions are effected. This program should include full review and specific FAA approval of service bulletins which may affect safety of flight.

COMMENT A-79-100(a):

A comprehensive revision to Order 8120.2 was published April 30, 1979. This revision places increased emphasis on improved surveillance techniques for safety of flight parts; provides for more effective utilization of inspectors in areas affecting safety; clearly defines the principal inspector's responsibility at assigned manufacturing facilities, expands on process control methods, and other related changes involving improved surveillance methods.

COMMENT A-79-100(b):

The FAA accepts this recommendation and has the following action underway:

(1) Analysis of the regulatory requirements of FAR 21.3, 37.17, 121.703, 121.705, 135.413, 135.415, and 145.163 concerning service difficulty reporting reveals need for revision and a regulatory project is in process.

(2) Upon establishment of adequate regulatory revision, our program of surveillance will be continued with emphasis on amended regulatory requirements.

(3) Also, as you are aware, the FAA has under development, with participation by NTSB, an Aviation Safety Analysis Program in order to implement an improved nationwide safety analysis system. This program includes consideration of service difficulties and the analysis and dissemination of such information.

(4) We have prepared an order to establish revised procedures for FAA approval of manufacturer service documents. This order and associated advisory circular have been prepared in draft form. The advisory circular is scheduled for publication in the Federal Register, in the near future, for public comment.

A-79-101

Assure that the Maintenance Review Board fully considers the following elements when it approves an Airline/Manufacturer Maintenance Program:

(a) Hazard analysis of maintenance procedures which involve removal, installation, or work in the vicinity of structural significant 1/ components in order to identify and eliminate the risk of damage to those components;

(b) Special inspections of structural significant components following maintenance affecting these components; and

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1/ Structural significant items as defined in Appendix 1 of Advisory Circular 120-17A - "Maintenance Control by Reliability Methods."

(c) The appropriateness of permitting "on condition" maintenance and, in particular, the validity of sampling inspection as it relates to the detection of damage which could result from undetected flaws or damage to structurally significant elements during manufacture or maintenance.

COMMENT A-79-101(a) and (b):

Both of these recommendations suggest that the Maintenance Review Board (MRB) function be expanded to include hazard analysis of maintenance functions and special inspections following maintenance of structural components. Thus, the recommendation incorporates the assumption that the MRB is the appropriate place for such functions. Both recommendations also incorporate the assumption that because the FAA approves the overall maintenance program, it also approves each and every maintenance procedure.

The prime function of an MRB is to establish the scope and frequency of inspection; i.e., on condition tests, or other inspection. The following is an excerpt from the MRB document, AC 121.22, which best describes the MRB function:

> "PURPOSE. This advisory circular sets forth guidelines to be used in the development and approval of initial maintenance/inspection requirements for air carrier transport category aircraft. These are applicable to newly type certificated aircraft and aircraft powerplants being introduced into service for the first time. Approval of proposed initial maintenance/inspection requirements will be accomplished by a board of FAA specialists, Maintenance Review Board (MRB). All revisions for updating the initial maintenance/inspection requirements will be submitted by an airline/manufacturer committee to the FAA for approval."

The MRB work is completed prior to the aircraft entering into service. The procedures to be utilized by the carriers are not necessarily developed at this time. In fact, at this time, the MRB does not address, or approve, maintenance procedures adopted by an airline. It therefore appears that the MRB is not the place to incorporate such functions.

With respect to the question of approval of maintenance procedures, our statutory and regulatory scheme provides as follows: The Federal Aviation Act, Section 601(b) reflects "the duty resting upon air carriers to perform their services with the highest possible degree of safety." The provisions of FAR 121.363 assign responsibility upon the air carrier for airworthiness of their aircraft. FAR 121.373 requires the air carrier to make continuing analysis of their maintenance programs. The variations necessary in the development of maintenance procedures require that the carrier be held responsible (in accordance with the Act) for the hazard analysis of maintenance practices. Since the MRB function is not to provide the basis for approval of an airline's total maintenance program, there is no reason to include maintenance hazard evaluations or special inspections following maintenance to critical structural components.

Maintenance programs for each airline are reviewed and approved by FAA maintenance inspectors assigned to each carrier. They continually monitor the programs and take corrective action when hazardous maintenance practices are discovered.

COMMENT A-79-101(c):

We agree that emphasis should be placed on assuring that no defects are permitted during manufacture and that damage is not inflicted during maintenance.

"On condition" and "sampling" inspection frequency and procedures are time proven techniques for a properly assembled product or item. We cannot envision how an MRB could have the insight to forecast which structurally significant components would suffer a manufacturing defect or damage due to a maintenance practice. However, the appropriateness of the type of inspection techniques for structurally significant components will be included in the agenda for the Maintenance Steering Group (MSG-3), which has been convened for the purpose of updating the maintenance analysis logic process.

A-79-102

Require that air carrier maintenance facilities and other designated repair stations:

(a) Make a hazard analysis evaluation of proposed maintenance procedures which deviate from those in the manufacturer's maintenance manual and which involve removal, installation, or work in the vicinity of structurally significant components; and

(b) Submit proposed procedures and analysis to the appropriate representataive of the Administrator, FAA, for approval.

COMMENT A-79-102(a)

Such a requirement is already imposed by the statutory provision of the Federal Aviation Act of 1958. Specifically, Section 605(a), and FAR 121.363 and 135.413 place responsibility directly upon the carriers for maintaining their aircraft in an airworthy condition. Additionally, FAR 121.373 and 135.431 require carriers to perform continuing analysis of their maintenance programs for adequacy. In proper exercise of that responsibility, it is incumbent upon air carriers and repair stations doing work for a carrier to analyze their maintenance practices for possible hazard to structure.

COMMENT A-79-102(b):

Present regulation FAR 121.369(b)(1) requires that the carrier set forth its maintenance procedures in a manual. FAR 121.137 requires that the manual and changes be provided to the FAA. This process does not signify FAA approval of each and every maintenance practice, or procedure, but is one which is designed to ensure that a carrier has clearly set forth its maintenance procedures. It is the duty of the carrier to ensure that these procedures, as part of several aspects of its maintenance program, are appropriate to maintaining the highest possible degree of safety.

A-79-103

Revise 14 CFR 121.707 to more clearly define "major" and "minor" repair categories to insure that the reporting requirement will include any repair of damage to a component identified as "structurally significant."

COMMENT A-79-103:

FAR 121.707 requires reporting when a major repair to a structural area is required. Thus the problem is whether the definition of a major repair, as stated in FAR 1 and 43, is adequate.

The FAA has conducted an analysis of the regulatory definitions set forth in FAR 1 and FAR 43, Appendix A. We have concluded that the present regulation is adequate and no revision is necessary, as explained in our report entitled "DC-10 Decision Basis" dated January 1980. However, an Advisory Circular is in preparation, to emphasize and call attention to the present regulation. The Advisory Circular is in the final coordination for early release.

A 79-104

Expand the scope of surveillance of air carrier maintenance by:

(a) Revising 14 CFR 121 to require that operators investigate and report to a representative of the Administrator the circumstances of any incident wherein damage is inflicted upon a component identified as "structurally significant" regardless of the phase of flight, ground operations, or maintenance in which the incident occurred; and

(b) Requiring that damage reports be evaluated by appropriate FAA personnel to determine whether the damage cause is indicative of an unsafe practice and assuring that proper actions are taken to disseminate relevant safety information to other operators and maintenance facilities.

COMMENT A-79-104(a):

We accept the recommendation and have a regulatory project in process that will amend FAR 121.703 and 135.413 to include maintenance induced damage, as stated above in response to NTSB Recommendation A-79-100(b).

COMMENT A-79-104(b):

When the regulatory project identified in A-79-104(a) above is completed, appropriate FAA review procedures for damage reports will be established. Of course, such a procedure currently exists for all damage reports presently received under existing regulations and procedures.

A-79-105

Revise operational procedures and instrumentation to increase stall margin during secondary emergencies by:

(a) Evaluating the takeoff-climb airspeed schedules prescribed for an engine failure to determine whether a continued climb at speeds attained in excess of V_2, up to V_2 + 10 knots, is an acceptable means of increasing stall margin without significantly degrading obstacle clearance.

(b) Amending applicable regulations and approved flight manuals to prescribe optimum takeoff-climb airspeed schedules; and

(c) Evaluating and modifying as necessary the logic of flight director systems to insure that pitch commands in the takeoff and go-around modes correspond to optimum airspeed schedules as determined by (a) and (b) above.

COMMENT A-79-105(a):

The FAA has initiated positive action in this regard. The Western Region conducted an evaluation of a representative sample of current jet transport aircraft to determine if the maintenance of a speed between V_2, and V_2 + 10 knots, if already attained at the time of engine failure, would increase the stall margin without infringing on takeoff flightpath requirements. A conclusion reached was that this concept has merit for selected aircraft, such as the DC-10, in certain flight conditions and the appropriate changes are being incorporated

into the Airplane Flight Manuals. However, it is not possible to make a general policy statement applicable to all air carrier aircraft without an extensive study of the takeoff performance and characteristics of each model of every aircraft in various configurations. FAA regions with certification responsibility for air carrier turbojet aircraft are being asked to evaluate each make and model of aircraft within their respective purview to provide data pertinent to the recommendation. Specific FAA actions will derive from a meeting of our Flight Standardization Policy Board (FSB) (established to provide standardization of training and checking airmen for each type of aircraft). The Flight Standardization Policy Board is scheduled to meet in April of 1980.

COMMENT A 79-105(b):

The FAR do not require the determination of optimum performance, but do require that certain performance criteria are met. Takeoff speeds, including V_2, are selected by the manufacturer applicant and the selected speeds and resulting flightpaths are shown to comply with the appropriate FAR. To prescribe an optimum takeoff-climb speed schedule is inappropriate since what is optimum for one set of parameters may not be optimum for another; e.g., close-in obstacles versus far-out obstacles, accelerate-stop versus accelerate-go, etc. The optimization of all variables is not possible and cannot be required.

Assuming that "optimum takeoff-climb airspeed schedules" refers to the unique situation during a takeoff-climb of maintaining a speed between V_2 and V_2 + 10 knots if already attained at the time of an engine failure, the FAA is presently analyzing the data and recommendations obtained from the regional studies referenced in response to (a). If the analysis reveals an equivalent level of safety, the appropriate data and procedures are being incorporated into the respective Airplane Flight Manuals (AFM). Further, this data also will be analyzed at the scheduled April meeting of the FAA's Flight Standardization Policy Board. If procedures in respective AFM's are revised, the FSB members will initiate actions to ensure that operators' training and checking procedures and operating manuals are appropriately revised.

COMMENT A-79-105(c):

Flight director systems of widebody aircraft are highly sophisticated special purpose computers. For example, the DC-10 flight director automatically computes V_2 + 10 for normal climb and makes modifications to V_2 in the case of an engine failure. The DC-10 flight director may have the capacity to meet the intent of the recommendation. Technically, different details apply to other widebody aircraft, but they, too, may have the capacity to meet the requirements envisioned by the recommendation.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: December 21, 1979

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-79-98 through -105

The National Transportation Safety Board has completed its determination of probable cause and final report on the American Airlines DC-10 accident in Chicago on May 25, 1979. The Safety Board's analysis of the evidence, and recommendations submitted to the Board by the other parties who participated in the investigation and public hearing, have identified several areas which we believe require the Federal Aviation Administration's (FAA) early attention. We recognize that the independent studies conducted by FAA following the accident also have identified needed specific actions, and the Safety Board is aware that several actions have already been taken or are anticipated as a direct result of those studies. While the Secretary of Transportation's current overview of the FAA's safety processes and the FAA's institution of a National Resource Specialist Program should generally enhance aviation safety, the Safety Board believes that further attention must be directed specifically toward fairly immediate solutions of some of the apparent deficiencies which led to this accident.

The Safety Board views the DC-10 accident with particular concern because the identified deficiencies touch almost every phase of aviation. First, the deficiencies raise concerns about aircraft design and certification. Putting aside any issue of whether or not the design of the DC-10 engine pylon assembly satisfied all of the structural requirements of the applicable regulations, its vulnerability to critical damage during maintenance apparently was not considered by either the manufacturer's design personnel or the FAA's certification review team. Additionally, the design of the aircraft's systems apparently failed to account for the possibility that a single event could simultaneously render critical portions of the flight control, hydraulic, and electrical systems inoperative. Although singularly, any one of these failures would probably have had little effect on the pilot's ability to fly the aircraft safely, in combination, they presented all but insuperable problems.

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Secondly, the Safety Board is concerned that discrepancies in fabrication unrelated to the Chicago accident found in a number of engine pylons on other DC-10 aircraft can be attributed to deficiencies in the manufacturing and quality control processes of a major airframe manufacturer. That the deficiencies were not detected by the manufacturer shows weaknesses in their quality assurance program and FAA's surveillance of that program. Furthermore, the DC-10 maintenance program established by the Maintenance Review Board permitted these discrepancies to escape detection even after the aircraft had been in commercial service for many years.

Another key problem uncovered in the investigation of this accident is the method through which operators could establish and introduce procedures to conduct major maintenance. Two major U.S. air carriers with extensive maintenance and engineering capabilities were able to introduce the maintenance procedure which led to damage of critical structural elements of DC-10 aircraft. Even though the procedure deviated from that recommended by the airframe manufacturer, apparently neither carrier performed or was required to perform a sufficiently comprehensive review of the procedure to allow it to foresee that the procedure could lead to hazardous damage. Furthermore, the FAA's maintenance inspection program contains no mechanism requiring review and analysis of the operator's maintenance procedures to assure that optimum safety levels are maintained.

It is of special concern that one of the air carriers persisted in using the variant maintenance procedure despite the fact that, on two separate occasions before the Chicago accident, it had discovered damage to the pylon assembly which had been introduced during maintenance. Had more comprehensive communication taken place between the carrier, the manufacturer, and the FAA regarding the damage and how it was being inflicted, action might have been taken which could have prevented the Chicago accident; however, neither incident was brought to the attention of the FAA (nor was it clearly required to be). The manufacturer was notified of the problem because a structural repair was required for which the carrier requested engineering assistance from the manufacturer. While the manufacturer, in a report to other DC-10 operators, included information concerning these incidents, the report which was distributed failed to place any emphasis on the significance of the event. As a result the information was treated routinely by carriers and none sufficiently analyzed the variant maintenance practice to ascertain its potential for causing damage which would affect the structural integrity of the aircraft.

Finally, the Safety Board believes that the operational aspects of this accident involved limitations in the prescribed engine failure procedure. Flight simulation conducted as part of the accident investigation disclosed that the aircraft could have continued to fly if

sufficient airspeed had been maintained, notwithstanding the extensive damage caused by the structural failure of the engine pylon assembly. Successfully flying the aircraft was, however, contingent upon immediate recognition of the need to maintain an airspeed above the procedurally prescribed airspeed schedule--recognition which was inhibited in this accident by the damage itself because it rendered the asymetric slat and stall warning systems inoperable. The Safety Board questions whether the prescribed procedures were optimal for all conditions and whether they could not have provided for a safer speed margin to cope with unforeseen emergencies without producing intolerable effects on other aspects of the aircraft's performance.

In this accident, the flightcrew was adhering to the prescribed engine failure procedure and corresponding flight director logic which required a climb at the takeoff safety speed (V_2). This speed was approximately 6 knots below the stall speed of the wing on which the leading edge slats had retracted. The aircraft had attained a speed more than 10 knots higher than V_2 when it first became airborne; however, as it decelerated to the target V_2 speed, the left wing stalled without warning resulting in a roll and impact. The Safety Board notes that approved flight manuals for some other aircraft prescribe an engine failure procedure wherein the speed attained in excess of V_2, up to V_2 + 10 knots, is maintained during the climb. The Safety Board believes that the FAA should evaluate and determine the acceptability of the latter procedure as a standard for the industry.

While the overall safety record of the current generation of jet aircraft clearly indicates a basically sound foundation for the regulatory oversight of U.S. commercial aviation and the commitment of the industry to safety, the Safety Board is concerned that this accident may be indicative of a climate of complacency. Although the accident in Chicago on May 25 involved only one manufacturer and one airline, the Safety Board is concerned that the nature of the identified deficiencies in design, manufacturing, quality control, and maintenance and operational procedures may reflect an environment which could involve the safe operation of other aircraft by other carriers.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Incorporate in type certification procedures full consideration of:

(a) Factors which affect maintainability, such as accessibility for inspection, positive or redundant retention of connecting hardware and the clearances of interconnecting parts in the design of critical structural elements; and

(b) Possible failure combinations which can result from primary structural damage in areas through which essential systems are routed. (Class II--Priority Action) (A-79-98)

Insure that the design of transport category aircraft provides positive protection against asymmetry of lift devices during critical phases of flight; or, if certification is based upon demonstrated controllability of the aircraft under condition of asymmetry, insure that asymmetric warning systems, stall warning systems, or other critical systems needed to provide the pilot with information essential to safe flight are completely redundant. (Class II--Priority Action) (A-79-99)

Initiate and continue strict and comprehensive surveillance efforts in the following areas:

(a) Manufacturer's quality control programs to assure full compliance with approved manufacturing and process specifications; and

(b) Manufacturer's service difficulty and service information collection and dissemination systems to assure that all reported service problems are properly analyzed and disseminated to users of the equipment, and that appropriate and timely corrective actions are effected. This program should include full review and specific FAA approval of service bulletins which may affect safety of flight. (Class II--Priority Action) (A-79-100)

Assure that the Maintenance Review Board fully considers the following elements when it approves an Airline/Manufacturer Maintenance Program:

(a) Hazard analysis of maintenance procedures which involve removal, installation, or work in the vicinity of structurally significant 1/ components in order to identify and eliminate the risk of damage to those components;

(b) Special inspections of structurally significant components following maintenance affecting these components; and

1/ Structural significant items as defined in Appendix 1 of Advisory Circular 120-17A - "Maintenance Control by Reliability Methods."

(c) **The appropriateness of permitting "on condition" maintenance and, in particular, the validity of sampling inspection as it relates to the detection of damage which** could result from undetected flaws or damage to structurally significant elements during manufacture or maintenance. (Class II--Priority Action) (A-79-101)

Require that air carrier maintenance facilities and other designated repair stations:

(a) Make a hazard analysis evaluation of proposed maintenance procedures which deviate from those in the manufacturer's maintenance manual and which involve removal, installation, or work in the vicinity of structurally significant components; and

(b) Submit proposed procedures and analysis to the appropriate representative of the Administrator, FAA, for approval. (Class II--Priority Action) A-79-102)

Revise 14 CFR 121.707 to more clearly define "major" and "minor" repair categories to insure that the reporting requirement will include any repair of damage to a component identified as "structurally significant." (Class II--Priority Action) (A-79-103)

Expand the scope of surveillance of air carrier maintenance by:

(a) Revising 14 CFR 121 to require that operators investigate and report to a representative of the Administrator the circumstances of any incident wherein damage is inflicted upon a component identified as "structurally significant" regardless of the phase of flight, ground operation, or maintenance in which the incident occurred; and

(b) Requiring that damage reports be evaluated by appropriate FAA personnel to determine whether the damage cause is indicative of an unsafe practice and assuring that proper actions are taken to disseminate relevant safety information to other operators and maintenance facilities. (Class II--Priority Action) A-79104)

Revise operational procedures and instrumentation to increase stall margin during secondary emergencies by:

(a) Evaluating the takeoff-climb airspeed schedules prescribed for an engine failure to determine whether a continued climb at speeds attained in excess of V_2, up to $V_2 + 10$ knots, is an acceptable means of increasing stall margin without significantly degrading obstacle clearance.

(b) Amending applicable regulations and approved flight manuals to prescribe optimum takeoff-climb airspeed schedules; and

(c) Evaluating and modifying as necessary the logic of flight director systems to insure that pitch commands in the takeoff and go-around modes correspond to optimum airspeed schedules as determined by (a) and (b) above. (Class II--Priority Action) (A-79-105)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in the recommendations.

James B. King

By: James B. King
Chairman

Office of the Chairman

National Transportation Safety Board

Washington, D.C. 20594

'Y 15 '81

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

This is to acknowledge the Federal Aviation Administration's (FAA) letter of April 17, 1981, further responding to National Transportation Safety Board Safety Recommendations A-80-1 and A-80-2 issued January 11, 1980. These recommendations stemmed from the Safety Board's investigation of a Swift Aire Lines, Nord 262, that ditched in the Santa Monica Bay, California, on March 10, 1979. We recommended that the FAA:

> A-80-1. Require changes to the Nord 262 operations manuals that (1) alert the flightcrew to the fact that an airborne engine restart is not possible unless the propeller has been feathered; and (2) provide guidance to the flightcrew regarding the urgency of completing the full engine shutdown procedure after the loss of an engine.

> A-80-2. Require a change to the Nord 262 operations manuals that specifies an engine runup and autofeather check before any flight when the air temperature is below 0° C.

The Safety Board is pleased to note that the FAA has issued Air Carrier Operations Bulletins 2-80-4 and 2-80-5, dated December 3, 1980, fulfilling both recommendations which we now classify in a "Closed--Acceptable Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 17, 1981

The Honorable James B. King
Chairman, National Transportation
  Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-80-1 and A-80-2 issued January 11, 1980. This also responds to your letter of February 27, 1981, in which the Board requested confirmation of completed action.

A-80-1. Require changes to the Nord 262 operations manuals that (1) alert the flightcrew to the fact that an airborne engine restart is not possible unless the propeller has been feathered; and (2) provide guidance to the flightcrew regarding the urgency of completing the full engine shutdown procedure after the loss of an engine.

A-80-2. Require a change to the Nord 262 operations manuals that specifies an engine runup and autofeather check before any flight when the air temperature is below 0° C.

FAA Comment. Enclosed is a copy of the Air Carrier Operations Bulletins 2-80-4 and 2-80-5, dated December 3, 1980. Bulletin 2-80-4 addresses Nord 262, Emergency Engine Shutdown Procedure, and Bulletin 2-80-5 addresses Nord 262 Runup Autofeather Check.

We believe this action is fully responsive to Safety Recommendation A-80-1 and 2. Accordingly, the Federal Aviation Administration considers action on these recommendations completed.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

NATIONAL TRANSPORTATION SAFETY BOARD
Office of the Chairman

Washington, D.C. 20594

FEB 27 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Please refer to the Federal Aviation Administration's (FAA) response dated April 10, 1980, to the National Transportation Safety Board's Safety Recommendations A-80-1 and 2. In our reply of June 4, 1980, we informed the FAA that we were keeping these recommendations in an "Open--Acceptable Action" status pending the FAA's issuance of an air carrier operations bulletin. In order to evaluate the status of these recommendations and update the public docket, we request your confirmation of completed action.

Sincerely yours,

James B. King

James B. King
Chairman

National Transportation Safety Board

Office of the Chairman

June 4, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your response to the National Transportation Safety Board Safety Recommendations A-80-1 and 2, issued January 11, 1980. These recommendations stemmed from the Safety Board's investigation of a Swift Aire Lines, Nord 262, that had ditched in the Santa Monica Bay, California, on March 10, 1979. The probable cause of the accident was the flightcrew's mismanagement of an emergency procedure after the right engine autofeathered, which resulted in the inadvertent shutdown of the left engine.

Safety Recommendations A-80-1 and 2 called upon the Federal Aviation Administration (FAA) to require certain changes in the Nord 262 operations manuals that provide guidance to the flightcrew for emergency procedures, such as airborne engine restart and the autofeather check. The Safety Board is pleased to note that the FAA concurs in both recommendations and plans to issue an air carrier operations bulletin to meet the objectives of the recommendations. Pending the issuance of the bulletin, both recommendations are classified as "Open--Acceptable Action."

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

April 10, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-1 and 2, issued by the Board on January 11, 1980. These recommendations resulted from the Board's investigation of a Swift Aire Lines, Inc., Aerospatiale Nord 262 which ditched in Santa Monica Bay after experiencing the loss of both engines shortly after takeoff from Los Angeles International Airport, California. One engine was inadvertently shut down.

During its investigation, the Board found evidence that indicated the pilots were unable to restart the left engine because they had failed to place the propeller control lever in the feather position. Propeller feathering is necessary before an engine can be restarted successfully on the Nord 262 aircraft.

The following are the Federal Aviation Administration's (FAA) comments and actions in response to these recommendations:

A-80-1. Require changes to the Nord 262 operations manuals that (1) alert the flightcrew to the fact that an airborne engine restart is not possible unless the propeller has been feathered; and (2) provide guidance to the flightcrew regarding the urgency of completing the full engine shutdown procedure after the loss of an engine.

Comment. We concur in this recommendation and must assume that the NTSB reference to "the Nord 262 operations manuals" refers to operations information maintained by the operator and not the FAA-approved airplane flight manual. We believe that the airplane flight manual does in fact provide sufficient guidance in this area. The emergency procedure for engine shutdown, if properly executed in accordance with the published checklist, will ensure that the engine control configuration is such that a restart can be successfully initiated. We will issue an air carrier operations bulletin to our field inspectors instructing them to ensure that proper emphasis is placed on air restart in the operator's training program and that the operator's operations manuals/checklists be reviewed for proper guidance on this procedure.

A-80-2. Require a change to the Nord 262 operations manuals that specifies an engine runup and autofeather check before any flight when the air temperature is below 0° C.

Comment. We concur in the recommendation and again must assume that the NTSB is referring to operations information maintained by the operator. Accordingly, we will include in the same operations bulletin guidance to the effect that field inspectors should ensure that operator's training programs, operations manuals, and checklists stress the importance of conducting an engine runup and autofeather check prior to flight in freezing weather conditions.

We believe that the foregoing actions will accomplish the objectives of recommendations A-80-1 and 2.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: January 11, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-1 and -2

On March 10, 1979, Swift Aire Lines, Inc., Flight 235, an Aerospatiale Nord 262, ditched in Santa Monica Bay after experiencing the loss of both engines shortly after takeoff from Los Angeles International Airport, California.

After liftoff from runway 24L, the right propeller autofeathered, and the right engine shut down. Seconds later the pilot apparently misidentified the failed engine and inadvertently shut down the left engine.

During its investigation, the National Transportation Safety Board found evidence that indicated the pilots were not able to restart the left engine because they had failed to place the propeller lever in the feather position. Propeller feathering is necessary before an engine can be restarted successfully on the Nord 262 aircraft.

At the time of the accident, there was no guidance in the company's Nord 262 operations manual indicating the urgency of setting the propeller control lever at "feather" while performing the post-autofeather procedure in order to perform a successful engine restart. After the accident, this deficiency was corrected in Swift Aire's operations manual; however, to our knowledge, no other Nord 262 operators have initiated manual changes of this nature.

The Safety Board believes this accident might have been prevented had the flightcrew been aware of the need to place the propeller lever in the feather position after engine shutdown since sufficient time was available for a successful restart.

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During its investigation of the Swift Aire accident, the Safety Board also learned that during cold weather operations Ransome Airlines had experienced numerous autofeather problems during Nord 262 engine runups and ground rolls for takeoff. Corrective action for some of these incidents required draining water from the autofeather propeller pressure hose.

As a result of these autofeather problems, Ransome Airlines initiated a requirement for engine runups and autofeather checks before the first flight of the day when the air temperature is below 0° C. This procedure reportedly has greatly reduced the number of autofeather problems previously experienced by this airline.

The use of this procedure indicates to the pilot that there is no blockage of the propeller feathering system, and it also minimizes an inadvertent activation of the autofeather system during takeoff which could be caused by trapped pressure in the airframe pitot system.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Require changes to the Nord 262 operations manuals that (1) alert the flightcrew to the fact that an airborne engine restart is not possible unless the propeller has been feathered; and (2) provide guidance to the flightcrew regarding the urgency of completing the full engine shutdown procedure after the loss of an engine. (Class II, Priority Action) (A-80-1)
>
> Require a change to the Nord 262 operations manuals that specifies an engine runup and autofeather check before any flight when the air temperature is below 0° C. (Class II, Priority Action) (A-80-2)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

May 7, 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Reference is made to the Federal Aviation Administration's (FAA) letter of April 17, 1981, further responding to National Transportation Safety Board Safety Recommendations A-80-13 issued February 13, 1980, and A-78-4 issued February 16, 1978. Since these recommendations are contained on separate greensheets in the public docket, they are being answered separately. This reply deals with the FAA's response to recommendation A-78-4.

Safety Recommendation A-78-4 stemmed from the Safety Board's investigation of a Piper PA-31 Navajo crash shortly after takeoff from Lake Minchumina, Alaska, on September 24, 1977. We recommended that the FAA:

> Issue an Airworthiness Directive applicable to Piper Cheyenne, Navajo, and Aztec airplanes to require a periodic inspection of the forward baggage door locks, and to establish an inspection procedure and repair or replacement requirements. The inspection should insure that the baggage door lock tang will not disengage from the door handle, and that the latching load imposed during handle operation is a specified minimum consistent with dynamic loads which can be encountered during all ground and flight operations.

We note from the FAA's responses of August 27, 1980, and April 17, 1981, that a study is underway to examine door lock problems and, based on this study, the FAA will determine further action. We also note that the FAA expects to complete this study by June of 1981, and will keep the Safety Board informed of progress in this area. Safety Recommendation A-78-4 remains classified in an "Open--Acceptable Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

MAY - 7 198

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Reference is made to the Federal Aviation Administration's (FAA) letter dated April 17, 1981, further responding to National Transportation Safety Board Safety Recommendations A-80-13 issued February 13, 1980, and A-78-4 issued February 16, 1978. Since these recommendations are made on separate greensheets and filed separately in the public docket, they are being addressed separately. This letter deals with the FAA's response to recommendation A-80-13.

Safety Recommendation A-80-13 stemmed from our investigation of an accident involving a Beech 70 Excalibur Conversion (Queen Air) which crashed after takeoff at Gulfport, Mississippi, on March 1, 1979. The nose baggage door came open and struck the propeller. We recommended that the FAA take action to provide double failure protection by means of a secondary locking device on nose baggage doors of light twin engine aircraft engaged in Part 135 operations.

The FAA's responses of May 13, 1980, and April 17, 1981, indicate that a study is being conducted to determine whether regulatory action is needed to satisfy this recommendation. We note that the FAA expects to complete this study by June of 1981, and will keep the Safety Board informed of significant progress in this area. Safety Recommendation A-80-13 remains classified in an "Open—Acceptable Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 17, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-80-13 and A-80-14 issued February 13, 1980, and supplements our letter of May 13, 1980. This also responds to your letter of February 27, 1981, in which you requested a further action report on Safety Recommendation A-80-13. A-80-14 was classified in a "Closed--Acceptable Action" status by official Board action on June 3, 1980.

The Federal Aviation Administration (FAA) is also responding to Safety Recommendation A-78-4 herein. This recommendation addresses the same subject and was issued February 16, 1978. Our most recent correspondence to the Board on this recommendation was dated August 27, 1980. On September 15, 1980, the NTSB asked to be informed about the results of the FAA study in progress and our subsequent actions. This letter responds to that request.

A-80-13. Take action to provide double failure protection by means of a secondary locking device on nose baggage doors of light twin engine aircraft engaged in Part 135 operations.

A-78-4. Issue an Airworthiness Directive applicable to Piper Cheyenne, Navajo, and Aztec airplanes to require a periodic inspection of the forward baggage door locks, and to establish an inspection procedure and repair or replacement requirements. The inspection should insure that the baggage door lock tang will not disengage from the door handle, and that the latching load imposed during handle operation is a specified minimum consistent with dynamic loads which can be encountered during all ground and flight operations.

FAA Comment. The FAA has initiated a study and is in the process of collecting additional accident, incident, service difficulty, and other data relative to these recommendations. We will determine what regulatory action, if any, is warranted after completion of this study. We expect our study to be completed by June of 1981, and we will keep the Board informed of significant progress in this area at that time.

Sincerely,

Charles E. Weithoner
Acting Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

SEP 15 .

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter dated August 27, 1980, responding further to National Transportation Safety Board Safety Recommendation A-78-4 issued February 16, 1978. We are pleased that the Federal Aviation Administration (FAA) Central Region has initiated a study to evaluate the nose baggage door locking mechanisms on all small multiengine aircraft and that this study will include a reassessment of the door locks in the Piper Cheyenne, Navajo, and Aztec airplanes.

We would be pleased to be informed about the results of this study and the FAA's subsequent actions. Safety Recommendation A-78-4 is now classified in an "Open--Acceptable Alternate Action" status.

Sincerely yours,

James B King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

August 27, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-78-4 issued February 16, 1978, and your request of May 5, 1980, that the Federal Aviation Administration (FAA) reevaluate the recommendation. This recommendation was issued as a result of the Board's investigation of the Piper PA-31 Navajo crash shortly after takeoff from Lake Minchumina, Alaska, on September 24, 1977.

The FAA Central Region, the lead region for certification of small aircraft, has initiated a study to evaluate the problems associated with the nose baggage door locking mechanisms of all small multiengine aircraft. As requested in your letter of May 5, we will ensure a reassessment of the door lock problems associated with the Piper Cheyenne, Navajo, and Aztec airplanes. We will inform the Board of the results of the study and subsequent action.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

May 5, 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

On February 16, 1978, the National Transportation Safety Board issued Safety Recommendation A-78-4, recommending that the Federal Aviation Administration issue an Airworthiness Directive applicable to the forward baggage door locks on Piper Cheyenne, Navajo, and Aztec airplanes. This Airworthiness Directive, the Board stated, should require inspection of these door locks and the establishment of repair or replacement requirements to insure that the door lock tang will not disengage from the door handle. Since the FAA did not take the prescribed remedial action or adequate alternative action, the status of this recommendation remains: "Open-unacceptable action."

In his letter of May 5, 1978, the Deputy Administrator indicated that the FAA had reviewed the design and had physically examined the latch and lock mechanisms of the door. He further stated that the FAA did not believe that the door, in good condition, would open in flight if it had been properly latched and locked. The key words here are in good condition and reflect the essential concern of NTSB to insure that the locks are in good condition. This is precisely why the Board recommended that they be inspected and repaired or replaced as necessary.

On June 9, 1978, the Piper Aircraft Corporation issued Service Bulletin No. 604 dealing with modification of the forward baggage door locking systems installed on the above-mentioned airplanes. On June 8, 1979, Piper issued Service Bulletin No. 604A which superseded Bulletin No. 604. The new bulletin revised serial numbers of the affected aircraft models, added kit information, and provided for modification of the door locking system as well as an inspection of the door lock arm assembly. Compliance with this bulletin to insure that the door is in good condition requires the installation of one or more kits, the availability of lock engagement tolerance data, and the non-routine removal of the baggage door lock arm assemblies.

In connection with the purpose of Bulletin 604A Piper states, in part, that:

> "...it is possible to close the door and turn the lock to the locked position without the lock tang actually engaging the door handle. As a result, the door would not be properly secured and could possibly come open in flight; this could adversely affect the flight characteristics of the airplane."

This stated purpose or concern clearly reflects the essential theme enunciated in Safety Board Recommendation A-78-4.

In view of the continuing potential hazards associated with faulty baggage door lock systems on the above aircraft, and in context with the manufacturer's recognition of this problem, the Safety Board requests that the FAA reevaluate Recommendation A-78-4.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 5, 1978

Honorable James B. King
Chairman, National Transportation Safety Board
800 Independence Avenue, S. W.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-78-4.

A-78-4. Issue an Airworthiness Directive applicable to Piper Cheyenne, Navajo, and Aztec airplanes to require a periodic inspection of the forward baggage door locks, and to establish an inspection procedure and repair or replacement requirements. The inspection should insure that the baggage door lock tang will not disengage from the door handle, and that the latching load imposed during handle operation is a specified minimum consistent with dynamic loads which can be encountered during all ground and flight operations.

Comment. We have reviewed the design and physically examined the latch and lock mechanisms of the door. We do not believe that the door, in good condition, will open in flight if it has been properly latched and locked.

We have taken the following actions dealing with the operation and maintenance of nose baggage/cargo doors.

Handbook 8430.1A, Change 10, Part 135, Operations Alert 72-2 issued on October 12, 1973, directed inspectors to contact all air taxi operators and request that procedures for flight crew checks of the security of all baggage and cargo doors be established and included in the carriers' operations manuals.

The 1976 General Aviation Inspection Aids Summary contains an item which emphasizes the necessity for proper locking and maintenance of nose cargo doors.

The January 1978 supplement to the General Aviation Inspection Aids contains an item involving an inflight nose cargo door opening and describes the condition of the lock, as found, along with recommendations for inspections.

Copies of the issuances noted above are enclosed.

We also exhibit a Service Difficulty Film at safety seminars. This film contains material relative to the maintenance and operation of baggage doors.

Available records of unwanted door openings on these airplanes do not support mandatory action as recommended, therefore, we do not plan such action at this time.

If you have any additional information which can be used to support further action we will appreciate your forwarding it to us.

Sincerely,

Quentin S. Taylor

Quentin S. Taylor
Deputy Administrator

3 Enclosures

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 16, 1978

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)
A-78-4

On September 24, 1977, a Piper PA-31 Navajo crashed shortly after takeoff from Lake Minchumina, Alaska, after the forward baggage door popped open. Cargo had been loaded into the forward baggage compartment just before this flight, and the pilot indicated that he had latched and locked this baggage door during the preflight inspection. Takeoff was made on a relatively rough gravel-dirt surface and some turbulence was encountered during climbout. The door came open shortly thereafter. The pilot attempted to return immediately to the airport but the airplane impacted Lake Minchumina before he could do so. The pilot and the five passengers aboard were rescued by a fishing boat. Later, the pilot stated that after the baggage door opened, it remained open, and he could not maintain control of the airplane.

As a result of its investigation of this accident, the Safety Board believes that this baggage door was latched and locked during the preflight inspection. However, the door apparently became unlocked and then opened sometime during the takeoff or climb.

This outward opening baggage door is hinged at the top and may be latched by rotating a bar handle into a recess in the plane of the door. The door may then be locked by inserting the key into the lock and turning it 90° counterclockwise. This action positions the locking tang into a slot in the door handle. However, because the lock mechanism or door handle may be loose or because the locking tang may rotate excessively, the door may not lock securely. This is particularly true in older

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airplanes or those with high service time. If, as a result of any applied forces, the locking tang is rotated upward and out of the slot in the door handle, the door may become unlatched inadvertently. Subsequent to the accident, an inspection of another Navajo airplane disclosed that the locking tang on that airplane could be easily lifted from below by inserting a small nail file. The ease of unlocking this door prompts concern that normal vibrational and inertial forces on the tang might produce the same result. (A similar locking device is installed on Piper Aztec and Cheyenne airplanes.)

To prevent a recurrence of this inadvertent door opening, the operator of the accident airplane (who also operates several other Piper aircraft with similar baggage door installations) has installed supplemental safety straps across the door handles to assure that they are latched and locked during flight.

In view of the potential hazards created by in-flight openings of these baggage doors--adverse aerodynamic effects on airplane controllability and ejection of cargo into propellers or adjacent structure--the Safety Board recommends that the Federal Aviation Administration:

> Issue an Airworthiness Directive applicable to Piper Cheyenne, Navajo, and Aztec airplanes to require a periodic inspection of the forward baggage door locks, and to establish an inspection procedure and repair or replacement requirements. The inspection should insure that the baggage door lock tang will not disengage from the door handle, and that the latching load imposed during handle operation is a specified minimum consistent with dynamic loads which can be encountered during all ground and flight operations. (Class II, Priority Action) (A-78-4)

BAILEY, Acting Chairman, McADAMS, HOGUE, and KING, Members, concurred in the above recommendation.

Kay Bailey

By: Kay Bailey
Acting Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

FEB 27 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D. C. 20591

Dear Mr. Weithoner:

Please refer to the Federal Aviation Administration's (FAA) letter of May 13, 1980, responding to the National Transportation Safety Board's Safety Recommendations A-80-13 and -14. In our reply of June 3, 1980, we informed the FAA that we had classified A-80-14 in a "Closed--Acceptable Action" status and that A-80-13 was being maintained in an "Open--Acceptable Alternate Action" status. In order to evaluate the progress of A-80-13 and update the public docket, we would appreciate a further report of actions taken.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

May 13, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-13 and 14, issued by the Board on February 13, 1980. These recommendations resulted from the Board's investigation of a fatal accident of a Beech 70 Excalibur Conversion (Queen Air), N777AE, which crashed just after takeoff on March 1, 1979, at Gulfport, Mississippi.

The investigation revealed that the nose baggage door came open during takeoff and struck the left propeller. The door apparently had not been secured properly by the station agent who had removed baggage from the compartment.

The following are the Federal Aviation Administration's comments and actions in response to these recommendations:

A-80-13. Take action to provide double failure protection by means of a secondary locking device on nose baggage doors of light twin engine aircraft engaged in Part 135 operations.

Comment. We concur in the intent of this recommendation. Action will be taken to initiate a study to determine if an additional nose baggage door locking mechanism is needed for any specific light twin engine aircraft engaged in Part 135 operations. If this study shows that an additional mechanism is needed on certain model airplanes, we will coordinate with the appropriate manufacturer to develop such an improvement. We will inform the Board of the results of the study and subsequent action.

A-80-14. Require that the nose baggage door interrupter system on all Beech Aircraft models so equipped be operational before flight.

Comment. We concur in the requirement that baggage door interrupter systems should be operational before flight.

Federal Aviation Regulations (FARs) 135.143a, 91.29, and 91.165 were cited by enforcement action that was completed on February 7, 1980, against Universal Airways, Inc., as a result of operating airplane N777AE in an unairworthy condition with the baggage door starter interrupter system inoperative.

Approved Minimum Equipment Lists that are related to FAR 135.179 do not mention the interrupter system; however, this system is specified by the type designs for the airplanes that are under consideration. Consequently, FAR 135.143 requires the interrupter system to be operational before flight for air taxi operations. For general operations, the same requirements are imposed by FARs 91.29 and 91.165.

Noncompliance with the above requirements, rather than the absence of requirements, caused the service difficulties cited by the Board. In order to achieve compliance, Order 8440.5A was revised on April 9, 1979, to incorporate revised Operations Bulletin Number 75-1. We also issued a Maintenance Note on page 12 of General Airworthiness Alert Number 10 during May 1979 (copies enclosed).

We believe that the foregoing actions will fulfill the objective of NTSB Safety Recommendations A-80-13 and 14.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosures

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

June 3, 1980

Honorable Langhorne Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter dated May 13, 1980, responding to the National Transportation Safety Board Safety Recommendations A-80-13 and 14 issued February 13, 1980. These recommendations stemmed from our investigation of a Beech 70 (Queen Air) crash just after takeoff at Gulfport, Mississippi, on March 1, 1979. The nose baggage door came open and struck the propeller.

The Safety Board is pleased to note that the Federal Aviation Administration (FAA) concurs with the intent of A-80-13 and that a study will be initiated of the baggage door locking mechanism for light twin engine aircraft. The status of this recommendation is classified as "Open--Acceptable Alternate Action."

In A-80-14, we recommended that the FAA require that the nose baggage door interrupter system on all Beech models be operational before flight. We note that the FAA concurs with this requirement and is enforcing such action. The status of this recommendation is classified as "Closed--Acceptable Action."

Sincerely yours,

James B. King
Chairman

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: February 13, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-13 and -14

On March 1, 1979, a Beech 70 Excalibur Conversion (Queen Air), N777AE, crashed just after takeoff from the Gulfport-Biloxi Regional Airport, Gulfport, Mississippi. The aircraft was being operated by Universal Airways, Inc., under 14 CFR 135.

The aircraft took off from runway 17 and reached an altitude of 100 feet at the departure end of the runway. At this time, the pilot told Gulfport Tower, "Universal 76 is taking it around, going to land, going to land on 13." Witnesses stated that as the aircraft began a right turn the nose "pitched up" following which the aircraft immediately entered a steep dive, which it maintained until ground impact. All eight occupants were killed; there was no fire after impact.

The investigation revealed that the nose baggage door came open on takeoff and struck the left propeller. The door apparently had not been secured properly by the station agent who had removed baggage from the compartment.

The forward baggage compartment door is hinged at the top and is opened by turning a D-shaped handle. The latching mechanism incorporates three sliding bayonet latches which are held in the latched position by an overcenter cam. A microswitch is mounted ahead of the forward bayonet and door frame and is connected in series to the left engine starter switch. The door must be fully latched and the microswitch actuated by the pressure of the bayonet point before the engine can be started. This feature was designed by Beech to ensure safety of operation of the aircraft. On N777AE, however, the safety interrupt feature had been bypassed by a wire installed between the battery terminals of the two-engine magneto/start switches. This allowed both engines to be started even though the door was not fully latched.

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In a similar accident involving a Ross Aviation Beech 65-80 (Queen Air) at Albuquerque, New Mexico, on May 19, 1972, nine persons were killed. As a result of that accident and a similar accident involving a Beech 99, the Safety Board issued Safety Recommendations A-72-78 through -81 directed to the Administrator. These recommendations dealt with the need for: secondary locking devices; cargo restraint systems; an alert to all air taxi operators; rulemaking to revise 14 CFR 135; and evaluation of the applicability of 14 CFR 23.787(b) to this type of nose cargo compartment.

The FAA issued an alert to all operators and owners regarding the need for positive door closure and for rigging the door actuating mechanism in accordance with the manufacturer's instructions. In addition, the FAA responded that if the door latching mechanism was properly maintained and fully secured by the operator, the requirements for cargo compartments and cargo security and protection contained in 14 CFR 23.787(b) would be satisfied. As you may know, based on this response the recommendations were "Closed - Unacceptable Action " by the Board.

In 1976, Beech Aircraft Corporation surveyed 66 Beech Queen Airs that were equipped with nose baggage doors. The findings of the survey indicated that only 10 of the 66 aircraft had properly operating starter interrupt systems.

In view of these findings, the unacceptable response to our previous recommendations and the Gulfport accident, the Safety Board concludes that action is still required to prevent inadvertent opening of nose baggage doors in flight. Therefore, the Safety Board recommends that the Federal Aviation Administration:

> Take action to provide double failure protection by means of a secondary locking device on nose baggage doors of light twin engine aircraft engaged in Part 135 operations. (Class II, Priority Action) (A-80-13)
>
> Require that the nose baggage door interrupter system on all Beech Aircraft models so equipped be operational before flight. (Class II, Priority Action) (A-80-14)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

April 17, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-80-24 and A-80-25 issued March 27, 1980, and supplements our letter of December 2, 1980. This also responds to your letter of January 19, 1981, in which you requested the Federal Aviation Administration (FAA) to reexamine relevant data pertaining to accident statistics for aircraft with tailwheels.

A-80-24. Amend FAR 61.31, "General Limitations," to require that before acting as pilot-in-command of a tailwheel airplane, a private or commercial pilot receive flight instruction (including all normal and contingent aspects of takeoffs and landings) from an authorized flight instructor who has found him competent to pilot such airplanes and has so endorsed his pilot logbook. This requirement need not apply to pilots who have logged flight time as pilot-in-command in tailwheel airplanes before the effective date of this amendment.

FAA Comment. As stated in our previous correspondence, we believe that a lack of pilot proficiency in general, rather than characteristics peculiar to tailwheel aircraft, was the primary causal factor in the accident cited in Safety Recommendations A-80-24 and 25. The pilot of this aircraft had received one hour of flight instruction in the aircraft from an authorized flight instructor immediately preceding his departure from Lock Haven, Pennsylvania. Consequently, we feel that a regulatory requirement such as the Board proposes would not have prevented this accident, or other accidents of this type. We further believe that this amendment would impose an economic hardship on the flying public without achieving the desired objectives.

In summary, we agree with the Board that an adequate checkout of pilots in tailwheel airplanes is essential. However, we believe that the same philosophy applies to the safe operation of any aircraft. We are making every effort to disseminate this philosophy to the flying public through

our various programs and educational materials, and we believe that an adequate basis for a comprehensive checkout has been provided by the FAA. We do not, however, believe that sufficient justification exists to pursue a change to Part 61. Based on our continuing programs and educational efforts, the FAA considers action completed on Safety Recommendation A-80-24.

A-80-25. Amend FAR 61.57, "Recent Flight Experience: Pilot in Command (c) General Experience," to make more stringent the currency requirements for the pilot in command of a tail wheel configured airplane carrying passengers.

FAA Comment. In our letter of June 25, 1980, the FAA stated that we would ". . . consider currency requirements for differently configured aircraft during our next review of Part 61 of the FAR." This review has not yet occurred, but it continues to be a high-priority item in our Regulatory Review Program. We hope to address this subject in the near future, and we will make the Board aware of our findings at that time.

Sincerely,

Charles E. Weithoner

Charles E. Weithoner
Acting Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

JAN 19 1981

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to your letter of December 2, 1980, responding further to National Transportation Safety Board Safety Recommendation A-80-24 issued March 27, 1980. We had recommended that the Federal Aviation Administration (FAA):

> "Amend FAR 61.31, "General Limitations," to require that before acting as pilot-in-command of a tailwheel airplane, a private or commercial pilot receive flight instruction (including all normal and contingent aspects of takeoffs and landings) from an authorized flight instructor who has found him competent to pilot such airplanes and has so endorsed his pilot logbook. This requirement need not apply to pilots who have logged flight time as pilot-in-command in tailwheel airplanes before the effective date of this amendment."

In your response, you refer to computer printouts from the FAA Safety Data Branch in Oklahoma and state that there is no significant difference between the causal factors of aircraft with nosewheels and aircraft with tailwheels. We disagree with this finding. Please refer to National Transportation Safety Board Special Study "Single-Engine, Fixed-Wing General Aviation Accidents 1972-1976 " (NTSB-AAS-79-1). On page 58, we conclude that aircraft with tailwheels have an accident rate more than double that of aircraft with nosewheels. Our chart on page 48 indicates that tailwheel aircraft ground loop 5.8 times more frequently than nosewheel aircraft. Since these facts have a significant bearing on the resolution of this recommendation, we request the FAA to reexamine relevant data. Pending the FAA's further response, A-80-24 remains classified in an "Open--Unacceptable Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

December 2, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, S.W.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-80-24 issued March 27, 1980, and supplements our letter of June 25, 1980. This also responds to your letter of August 12, 1980, in which you request that the FAA reevaluate this recommendation.

A-80-24.

Amend FAR 61.31, "General Limitations," to require that before acting as pilot-in-command of a tailwheel airplane, a private or commercial pilot receive flight instruction (including all normal and contingent aspects of takeoffs and landings) from an authorized flight instructor who has found him competent to pilot such airplane and has so endorsed his pilot logbook. This requirement need not apply to pilots who have logged flight time as pilot-in-command in tailwheel airplanes before the effective date of this amendment.

FAA Comment.

As previously stated in our letter of June 25 we believe that an adequate checkout of a pilot in any aircraft is essential to the safe operation of that aircraft.

We have reviewed computer printouts from the FAA Safety Data Branch in Oklahoma concerning accidents involving tailwheel aircraft during the takeoff and landing ground roll phase of flight. These data indicate that the causal factors were not peculiar to tailwheel aircraft or significantly different from those of nosewheel aircraft accidents. Ground loops, loss of directional control, and runway overruns were also factors common to accidents in both aircraft types.

The circumstances surrounding the crash of the PA-18 Super Cub at Lebanon, New Hampshire, on April 21, 1979, indicate that a lack of pilot proficiency in general, rather than characteristics peculiar to tailwheel aircraft, may have contributed to that tragedy. We have determined that the pilot received 1 hour of flight instruction from a certificated flight instructor immediately prior to his departure from Lock Haven, Pennsylvania.

An amendment to FAR 61.31 would not necessarily provide a solution to the concerns outlined in Safety Recommendation A-80-24. To require a private or commercial pilot to receive flight instruction from an authorized flight instructor in tailwheel aircraft, with an appropriate endorsement in his pilot log, would not ensure that the pilot's checkout was adequate. In this instance, the dual flight instruction received was apparently not adequate to preclude this tragedy.

The responsibility for determining the adequacy of a checkout rests with the flight instructor. In our judgment this is a proper assignment of responsibility. For these reasons, the FAA does not believe that the regulatory action recommended by the Board pertaining to tailwheel aircraft is justified, and accordingly, we consider action on Safety Recommendation A-80-24 completed.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

June 25, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-24 and 25, issued by the Board on March 27, 1980. These recommendations resulted from the Board's investigation of the crash of a Piper Model PA-18 Super Cub at the Lebanon Regional Airport, Lebanon, New Hampshire, on April 21, 1979.

The following are the Federal Aviation Administration's (FAA) comments and actions in response to these recommendations:

A-80-24. Amend FAR 61.31, "General Limitations," to require that before acting as pilot-in-command of a tailwheel airplane, a private or commercial pilot receive flight instruction (including all normal and contingent aspects of takeoffs and landings) from an authorized flight instructor who has found him competent to pilot such airplanes and has so endorsed his pilot logbook. This requirement need not apply to pilots who have logged flight time as pilot-in-command in tailwheel airplanes before the effective date of this amendment.

A-80-25. Amend FAR 61.57, "Recent Flight Experience: Pilot in Command (c) General Experience," to make more stringent the currency requirements for the pilot in command of a tail wheel configured airplane carrying passengers.

Comment. We concur with the Board that an adequate checkout of pilots in tailwheel aircraft is essential. However, we believe that the same philosophy applies equally to safe operation of any aircraft. The accident involving a Piper Model PA-18 Super Cub referred to in the recommendations reflects an overall lack of pilot proficiency including landing and go-around procedures.

Educational material, such as the Flight Training Handbook AC 61-21A, provides valuable information to instructors and pilots transitioning to aircraft with significantly different flight characteristics, performance capabilities, and operating procedures from those which the pilot has previously flown. The publications issued by the FAA in the Accident Prevention Program, such as the enclosed copy of "Some Hard Facts About Soft Landings," are available to instructors and pilots. The private and commercial pilot flight test guides, AC 61-54A and AC 61-55A, respectively, provide additional information concerning tailwheel aircraft operational procedure (copies enclosed).

Consequently, we believe that requirements of the FAR, when coupled with the educational materials available through the FAA, adequately provide the basis for a comprehensive checkout in tailwheel configured aircraft.

We, of course, share the Board's concern for safety in all aspects of flight operations. Accordingly, in addition to the comprehensive efforts described above, we will also carefully consider currency requirements for differently configured aircraft during our next review of Part 61 of the FAR.

We believe these actions serve to provide adequate information and guidance regarding the concerns expressed in NTSB Safety Recommendations A-80-24 and 25.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

3 Enclosures

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: March 27, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C., 20591

SAFETY RECOMMENDATION(S)

A-80-24 and -25

On April 21, 1979, a Piper Model PA-18, Super Cub crashed at the Lebanon Regional Airport, Lebanon, New Hampshire. The sky was clear and although the wind was calm, the airplane was observed to bounce severely several times during the attempted landing. The airplane then turned right, and a go-around was initiated. Shortly thereafter, the aircraft crashed near the airport boundary and burned. The pilot was killed, and his passenger was seriously injured.

The pilot had flown this new airplane from the Piper factory at Lock Haven, Pennsylvania, and was in the process of delivering it to Lebanon when the accident occurred. Although he had accumulated several hundred flight hours in tricycle gear aircraft, his experience in tailwheel airplanes was limited to about 5 hours. Moreover, before the date of the accident, he had not flown in a tailwheel airplane for 2 years. While the pilot made a number of takeoffs and landings with a flight instructor in the PA-18 immediately before he departed for Lebanon, the Safety Board believes that the scope of this familiarization was inadequate and did not prepare him sufficiently to take charge of the aircraft.

The Safety Board believes that the severe bouncing observed during the landing attempt clearly indicates that the pilot did not perform the landing flare maneuver properly. Moreover, lack of skill in the operation of tailwheel airplanes was further evidenced by the pilot's delay in initiating a go-around. The go-around, although belated, would still have been successful if the pilot had been thoroughly familiar with this aircraft. Lacking such familiarity however, he apparently failed to retrim the airplane from an approach trim setting to a go-around setting since the adjustable stabilizer was found in the full airplane nosedown position. The resultant stick forces would have been very high during the attempted go-around and particularly disconcerting to this pilot with limited experience in tailwheel airplanes.

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The safe operation of tailwheel airplanes requires a unique measure of operational familiarization that is not transferable from experience in tricycle gear aircraft. Tailwheel airplanes are especially prone to loss of directional control during takeoff and landing, and to severe bouncing if the landing is not performed properly. The pilot's knowledge and level of proficiency concerning crosswind takeoffs and landings, power (wheel) landings, recovery from bounced landings, and go-around procedures is particularly critical to safe operation of tailwheel aircraft. A special study 1/ by the Safety Board has shown that the total accident rate for tailwheel aircraft is more than twice that of aircraft with tricycle landing gear.

The Safety Board believes that an adequate checkout of pilots in tailwheel airplanes is essential and that continued safe operation of these airplanes requires a minimum level of recent experience somewhat greater than presently required. The checkout should focus on safe takeoffs and landings and should provide measurable assurance of the pilot's capability to operate the airplane in all phases of flight. Consequently, the Safety Board recommends that the Federal Aviation Administration:

> Amend FAR 61.31, "General Limitations," to require that before acting as pilot-in-command of a tailwheel airplane, a private or commercial pilot receive flight instruction (including all normal and contingent aspects of takeoffs and landings) from an authorized flight instructor who has found him competent to pilot such airplanes and has so endorsed his pilot logbook. This requirement need not apply to pilots who have logged flight time as pilot-in-command in tailwheel airplanes before the effective date of this amendment. (Class II, Priority Action) (A-80-24)

> Amend FAR 61.57, "Recent Flight Experience: Pilot in Command (c) General Experience," to make more stringent the currency requirements for the pilot in command of a tail wheel configured airplane carrying passengers. (Class II, Priority Action) (A-80-25)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

1/ "Single-engine, Fixed-wing General Aviation Accidents, 1972-1976 (NTSB-AAS-79-1).

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

May 12, 1981

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Please refer to National Transportation Safety Board (NTSB) letter dated September 8, 1980, regarding Safety Recommendations A-80-28 and -29 issued April 9, 1980. These are two of three recommendations that stemmed from a Learjet-36 incident which occurred on January 1, 1980. In our letter we stated that companion recommendation A-80-27 was classified "Closed--Acceptable Alternate Action" but that we were maintaining A-80-28 and A-80-29 in an "Open--Acceptable Action" status pending (1) our further investigation of the cause of the "O" ring failure, and (2) completion of the Federal Aviation Administration's (FAA) actions with regard to A-80-29.

At the NTSB/FAA Quarterly Meeting held on February 12, 1981, our staff representative stated that we had found no manufacturing defect, and that the Safety Board would inform the FAA in writing with regard to closing Safety Recommendation A-80-28. This is to confirm that the status of this recommendation is now classified "Closed--Acceptable Alternate Action."

With regard to Safety Recommendation A-80-29 we note that the FAA has issued Airworthiness Directive, Revision 80-19-09 R1, Gates Learjet, which requires the installation of motive flow valve shrouds and drain lines before February 13, 1981. This completes actions for A-80-29 which we now classify in a "Closed--Acceptable Action" status.

We thank the FAA for actions taken.

Sincerely yours,

James B. King
Chairman

National Transportation
Safety Board

Washington, D.C. 20594

Office of
Chairman

SEP 8 1980

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter responding to National Transportation Safety Board Safety Recommendations A-80-27 through 29, issued April 9, 1980. These recommendations stemmed from a Learjet-36 incident which occurred on January 1, 1980. A fuel leak was discovered in the tailcone service area during a postflight inspection.

In A-80-27 we recommended that the Federal Aviation Administration (FAA) notify Learjet operators by telegram of the motive flow valve leak found in this incident, and require inspections of these valves. We are pleased to note that the FAA issued Airworthiness Directive (AD) 80-09-06, effective May 8, 1980, to fulfill the intent of this recommendation, which is now classified as "Closed--Acceptable Alternate Action."

In A-80-28 we recommended that the FAA review the manufacturing process used in assembling the motive flow valve to determine the cause of the "O" ring failure. Although this was done, we are not satisfied with the finding that no manufacturing defect was found. The manufacturing process of the valve is under investigation by Safety Board investigators and we expect to complete our investigation within 3 weeks. We will appreciate any assistance given by the FAA in this matter. For the present we are maintaining A-80-28 in an "Open--Acceptable Action" status.

In A-80-29 we recommended that the FAA expedite the development and installation of a method for restraining and venting overboard fuel and fuel vapors that may leak from the motive flow valve during its normal

operation. We note that this recommendation is in process of fulfillment and that we will be advised when action is completed. Pending the FAA's further response, A-80-29 is classified in an "Open--Acceptable Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

July 8, 1980

The Honorable James B. King
Chairman, National Transportaion
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-27 through 29, issued by the Board on April 9, 1980. These recommendations resulted from the Board's investigation of an incident which occurred January 1, 1980, wherein a fuel leak was discovered in the tailcone service area of a Learjet-36 during a postflight inspection.

Following are the Federal Aviation Administration's (FAA) comments and actions in response to these recommendations:

A-80-27. Notify all Learjet operators by telegram of the motive flow valve leak found in this incident, and require an immediate and a recurring inspection of these valves under operating pressures to detect and correct any fuel leaks found.

Comment. Airworthiness Directive (AD) 80-09-06 (copy enclosed) was effective May 8, 1980, and required, within 25 hours, a complete initial inspection of the tailcone service area for leaks, sources of ignition, or obstruction of vents and drains immediately after engine shutdown at the conclusion of each flight. Since there was no accident or incident involving ignition of fuel leaks in the tailcone area, and the air in the area is changed 8 to 11 times per minute while in flight, the probability of having a combustible mixture in the area does not appear to justify a telegraphic AD.

A-80-28. Review the manufacturing processes used in assembling the motive flow valve to determine the cause of this "O" ring failure and take appropriate action to correct any deficiencies detected to preclude future fuel leaks from the motive flow valve during its normal operations.

Comment. Examination of the valve body revealed no apparent cause for "O" ring separation. The bore in the valve body shows evidence of score marks, which coincide with the position of the nylon thermal relief plug on the rotor. The score marks could have been caused by particles of contaminant on the plug when it rotated in the valve body. The "O" ring grooves in the rotor were smooth and there were no rough areas where the "O" ring contacts the valve body. No manufacturing defect which could contribute to the failure could be found. Since the valve had been in operation for over 1,600 hours at the time of failure, it is unlikely that the "O" ring was damaged during assembly.

A-80-29. Expedite the development and installation of a method of restraining and venting overboard, fuel and fuel vapors that may leak from the motive flow valve during its normal operations.

Comment. Gates Learjet investigated the possibility of a design change to preclude fuel leaking from the motive flow valve from being sprayed into the tailcone area. To accomplish that objective, the valve manufacturer is processing a design change to enclose the valve in a sheet metal enclosure with a drain line to permit any leakage to be drained overboard. When this design becomes available in the field, AD 80-09-06 will be revised to exempt those airplanes having the change incorporated from the post flight inspection requirement.

We believe the preceding actions will correct the deficiencies which concerned the Board in Safety Recommendations A-80-27 through 29. Accordingly, the FAA considers action completed on Recommendations A-80-27 and 28. We will advise the Board when design change is completed and available in the field, thereby completing action on Recommendation A-80-29.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosure

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: April 9, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-27 through -29

The National Transportation Safety Board has learned of an incident which occurred January 1, 1980, wherein a fuel leak was discovered in the tailcone service area of a Learjet-36 during a postflight inspection. The leak was traced to the left motive flow valve (PN AV16E1182) (SNH46478) which is located in the tailcone service area where the batteries and other electrical components are positioned. The valve had operated about 1,663 hours. It was reported that, when the valve was pressurized, fuel spurted about 5 inches into the air and sprayed into the service area in sufficient quantity to wash soot from installed equipment in the compartment. Portions of the electrical junction box adjacent to the valve were saturated with fuel.

The valve was removed and forwarded to the Gates Learjet Corporation under warranty for replacement, and a Service Difficulty Report, No. 01110043, was prepared. Under the Safety Board's supervision, the valve was X-rayed, examined visually, and then bench-tested at the Gates Learjet facility in Wichita, Kansas. The X-ray and the visual examination did not reveal any apparent defects. The screws that attached the valve motor to the valve body were tight and properly safetied. The cure dates of the "O" rings were marked "4th quarter 1974" and the assembly date was September 5, 1974.

The valve was installed in a pressure test device and tested at the normal operating pressures it would experience in the aircraft. Fluid leaked at the mounting plate where the valve motor attached to the valve body. The test results were:

Pressure	Rate of leakage (gph)
250 psi	5.54
310 psi	5.23
500 psi	6.49
310 psi	5.10
250 psi	4.43

2904

The valve motor was then removed from the valve body. The mating surfaces were clean, and there were no visible defects. The upper "O" ring (MS29513-16) was found to be broken into 3 pieces, and one piece was found between the valve body and the cylinder wall. The lower "O" ring was intact.

A review of Federal Aviation Administration service difficulty reports uncovered two additional reports, dated 1975 and 1977, of fuel leaks in motive flow valves installed on Gates Learjet aircraft.

The Safety Board is concerned about the extreme hazard that would be associated with having a relatively high-volume fuel leak in a compartment where there are many potential ignition sources. In its report of an accident involving a Gates Learjet at Sanford, North Carolina, the Safety Board determined that the probable cause of the accident was ". . . one or more low-order explosions in the aircraft's aft fuselage which resulted in a fire and loss of control capability. The Safety Board could not determine conclusively the fuel and ignition sources of the initial explosion; however gases from the aircraft's batteries or fuel leaks from fuel system components, or both, could have been present in the area of the initial explosion." 1/

The Safety Board is aware that the FAA is reviewing the information gathered during the examination and testing of the motive flow valve involved in this incident. We are also aware that the Gates Learjet maintenance manual was revised on September 28, 1979, to require a check of the hydraulic and fuel system components in the tailcone of Learjet aircraft for general condition and leaks during postflight inspections following major inspections, repairs, or alteration to the aircraft. Finally, we have been informed that the FAA and Gates Learjet are considering the installation of a shroud, with overboard drains, around the motive flow valve assembly. However, we believe the hazard associated with a fuel leak in the tailcone area of these aircraft requires additional corrective action. Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Notify all Learjet operators by telegram of the motive flow valve leak found in this incident, and require an immediate and a recurring inspection of these valves under operating pressures to detect and correct any fuel leaks found. (Class I, Urgent Action) (A-80-27)
>
> Review the manufacturing processes used in assembling the motive flow valve to determine the cause of this "O" ring failure and take appropriate action to correct any deficiencies detected to preclude future fuel leaks from the motive flow valve during its normal operations. (Class II, Priority Action) (A-80-28)

1/ For more detailed information, read "Aircraft Accident Report — Champion Home Builders Company, Gates Learjet 25B, N999HG, Sanford, North Carolina, September 8, 1977" (NTSB-AAR-79-15)

Expedite the development and installation of a method of restraining and venting overboard, fuel and fuel vapors that may leak from the motive flow valve during its normal operations. (Class II, Priority Action) (A-80-29)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Memt concurred in these recommendations.

By: James B. King
Chairman

US Department of Transportation
Federal Aviation Administration

Office of the Administrator

800 Independence Ave S W
Washington, D C 20591

JUN 29 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-80-35 issued May 7, 1980. In your June 3, 1981, letter you advised that, pursuant to our action outlined in our February 26, 1981, letter, you had placed this recommendation in an "Open--Acceptable Action" status.

A-80-35. Amend Airworthiness Directive 78-12-06 to require periodic nondestructive inspections of Cleveland P/N 40-76B and P/N 40-120A nose wheels on Piper model PA-31 aircraft.

FAA Comment. In our February 26, 1981, letter to you we stated that we had issued a notice of proposed rulemaking to adopt an airworthiness directive (AD) to require inspection of nose wheels on Piper PA-31, PA-31-325, and PA-31-350 airplanes. FAA issued AD 81-11-04 on May 15, 1981. A copy is enclosed. We consider action on this recommendation completed.

Sincerely,

Helms

J. Lynn Helms
Administrator

Enclosure

PRECEDING PAGE BLANK-NOT FILMED

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

JUN - 3

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Reference is made to the Federal Aviation Administration's (FAA) letter dated February 26, 1981, further responding to National Transportation Safety Board Safety Recommendation A-80-35 issued May 7, 1980. This recommendation stemmed from our investigation of an incident involving a Piper aircraft, Model PA-31-350, at Washington National Airport, Washington, D.C., on September 19, 1978. While the aircraft was being taxied, the nose gear collapsed. We recommended that the FAA amend Airworthiness Directive (AD) 78-12-06 to require periodic nondestructive inspections of Cleveland P/N 40-76B and P/N 40-120A nose wheels on Piper model PA-31 aircraft.

We note from your letter that the FAA has initiated a Notice of Proposed Rulemaking to adopt an AD which will require the inspection of the nose wheel and replacement of wheels found with cracks on certain Piper models PA-31, PA-31-325, and PA-31-350 airplanes. We believe that the adoption of the AD will satisfy the intent of Recommendation A-80-35 which we are maintaining in an "Open-Acceptable Action" status.

We thank the FAA for the careful consideration given to this recommendation.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

February 26, 1981

OFFICE OF
THE ADMINISTRATOR

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Recommendation A-80-35 issued May 7, 1980, and supplements our letter of August 6, 1980.

A-80-35. Amend Airworthiness Directive 78-12-06 to require periodic nondestructive inspections of Cleveland P/N 40-76B and P/N 40-120A nose wheels on Piper model PA-31 aircraft.

FAA Comment. In our August 6, 1980, letter, we advised the Board that our initial analysis of Service Difficulty Reports indicated a variety of causes of failures experienced, such that additional investigation was required to determine whether some specific corrective action(s) was required. Our investigation has revealed the following:

Discussion of the PA-31T and AD 78-12-06. In 1977, the PA-31T was using the Cleveland P/N 40-76B wheel as an optional high flotation wheel with a 10-ply rating 17.5 by 6.25-6 tire. This wheel has TSO approval and had been tested at 55 psi maximum tire pressure. Piper, however, established the tire pressure at 80 psi. Failures were reported and Piper attributed them to the 3-bolt design used in holding the two-wheel halves together. Therefore, Piper chose a 6-bolt wheel, P/N 40-120A, and maintained the 80 psi tire pressure. Piper Service Bulletin No. 568 was issued on April 26, 1977, calling for a no-cost replacement of the P/N 40-76B with the P/N 40-120A wheel within the next 25 hours of operation. The tire used on both was the 17.5 x 6.25-6 10-ply rating size. The FAA did not issue an AD.

Following this, failures have been reported with the P/N 40-120A wheel. Cleveland Company advised that this wheel had been TSO-tested with a 6.00-6 tire at 54 psi maximum pressure.

Apparently, at Piper's request, Cleveland Company attempted to requalify the wheel using the larger 10-ply rating tire with the tire pressure increased to 80 psi, but was unable to do so.

Piper then issued Service Bulletin No. 599 by Telex on April 21, 1978, calling for a preflight inspection of the P/N 40-120A wheel. Airworthiness Directive 78-12-06 was issued on June 22, 1978, by the Eastern Region which called for a preflight inspection of PA-31T aircraft having the P/N 40-120A nose wheel (as in Piper Bulletin 599).

On October 4, 1978, Piper issued Service Bulletin No. 599-A making available a Goodrich P/N 3-1076 wheel, Piper P/N 551-782, as an option to the Cleveland P/N 40-120A. It was noted that with this optional Goodrich wheel installed, compliance with the preflight inspection was no longer required.

On May 9, 1979, the FAA amended AD 78-12-06 to add the optional Goodrich P/N 3-1076 wheel, as noted in Piper Bulletin 599-A and an additional optional Goodrich P/N 3-1331 wheel, Piper P/N 551-758.

A review of the FAA Maintenance Analysis Center records from June 1974 to July 1980 indicated only six failures were reported on the PA-31T's in a 6-year period. All of these failures occurred between March 14, 1978, and April 27, 1979, and no failures have been reported since the May 9, 1979, amendment date of the AD providing for the optional Goodrich wheels. These statistics strongly indicate that this problem no longer exists. Additionally, the fact that only 30 aircraft were ever equipped with this optional high flotation wheel/tire combination, further supports our contention that no change to AD 78-12-06 affecting PA-31T aircraft is necessary.

Discussion of the PA-31 series with Cleveland P/N 40-76B wheel. The NTSB recommendation is to amend AD 78-12-06 to include Cleveland P/N 40-76B wheel used on the PA-31 series aircraft and to require periodic nondestructive inspections, presumably instead of the preflight inspection.

The basis for this recommendation was the occurrence on September 19, 1978, of a nose wheel failure on a PA-31-350 during taxiing which, for reasons now unknown, was reported to result in the collapse of the nose landing gear. In addition, a survey of the FAA Maintenance Analysis Center records indicated that 36 cracked or failed nose wheel assemblies have been reported over the last 5 years. Six of the reported cases involved the Cleveland P/N 40-120A wheel installed on Piper PA-31T model aircraft; the remaining reports involved the Cleveland P/N 40-76B wheel installed on various models of the PA-31 series aircraft.

A further review has been made of FAA records dating from June 1974, the beginning of the computerized storage system, through July 24, 1980. These records show 33 failures on the PA-31-350, 1 on the PA-31-325, and 10 on the PA-31, for a total of 44 certain failures. In addition,

there were 5 possible failures resulting in a probable total of 49 during this 6-year period. The failures are identified as cracked or broken rims or flanges.

The number of PA-31 series aircraft delivered for service is slightly over 3,000. The number of failures is relatively small and amounts to slightly over 1 percent, but the failures per year are as follows:

1975	1976	1977	1978	1979	1980 (Jan-June)
3	2	6	10	10	18

Seven of the ten in 1979 occurred the last half of the year and this increase is probably caused by the accelerated use of the PA-31-350 in air taxi and commuter service as a result of deregulation. In view of this adverse trend, the FAA concurs in this portion of the recommendation and has initiated a Notice of Proposed Rule Making (NPRM) to adopt an AD which will require the inspection of the nose wheel and replacement of wheels found with cracks on certain Piper models PA-31, PA-31-325, and PA-31-350 airplanes. A copy of this NPRM (Docket No. 80-SO-78) is enclosed.

We have also recommended to Piper Lakeland that a production change be instituted so as to make available a preferred spare Cleveland Nose Wheel P/N 40-140 or an equivalent wheel supplied by any other wheel manufacturer. The P/N 40-140 wheel is more rugged and should provide longer life.

This wheel was developed as a replacement for the P/N 40-120A covered by the AD and has been approved by Piper Lock Haven for the PA-31T. The P/N 40-140 wheel has also been selected by Piper Lakeland for use on the PA-42 (Cheyenne III). This wheel exceeds the TSO minimum standards according to the manufacturer; specifically, it has been towed under load more than twice the 1,000 mile distance required by the TSO.

We believe the preceding actions will correct the concerns identified in NTSB Safety Recommendation A-80-35. Accordingly, FAA considers action on this recommendation completed.

Sincerely,

Charles E. Weithoner
Acting Administrator

Enclosure

National Transportation Safety Board

Washington, D.C. 20594

Office of
Chairman

2

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter responding to National Transportation Safety Board Safety Recommendation A-80-35 issued May 7, 1980. This recommendation stemmed from our investigation of an incident involving a Piper aircraft, Model PA-31-350, at Washington National Airport, Washington, D.C., on September 19, 1978. While the aircraft was being taxied, the nose gear assembly collapsed. We recommended that the Federal Aviation Administration (FAA):

> "Amend Airworthiness Directive 78-12-06 to require periodic nondestructive inspections of Cleveland P/N 40-76B and P/N 40-120A nose wheels on Piper Model PA-31 aircraft."

We note that after conducting a review and analysis of the problem the FAA will advise the Safety Board of its decision, which we can expect shortly. Pending the FAA's further response, Safety Recommendation A-80-35 is being maintained in an "Open--Acceptable Action" status.

Sincerely yours,

Patricia Goldman

James B. King
Chairman

for

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

August 6, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-80-35 issued by the Board on May 7, 1980. This recommendation resulted from the Board's investigation of an incident involving a Piper Model PA-31-350, at Washington National Airport, Washington, D.C., on September 19, 1978. The incident occurred when the pilot taxied forward a short distance for a brake check. Upon brake application, the nose wheel failed and then cocked against the gear fork assembly, resulting in damage to the gear retract mechanism and subsequent collapse of the nose gear assembly.

A-80-35. Amend Airworthiness Directive 72-12-06 to require periodic nondestructive inspections of Cleveland P/N 40-76B and P/N 40-120A nose wheels on Piper model PA-31 aircraft.

Comment. Airworthiness Directive 78-12-06, which was issued May 9, 1979, required only a visual inspection of Piper Model PA-31T aircraft nose wheel assemblies, Cleveland P/N 40-120A, before each flight. This is in contrast to the Board's recommendation that the Airworthiness Directive be amended to require periodic nondestructive inspections of both Cleveland P/N 40-120A and P/N 40-76B nose wheels on all Piper Model PA-31 aircraft.

The Federal Aviation Administration's (FAA) initial analysis of Service Difficulty Reports related to these parts indicates a variety of causes of the failures experienced, such that additional investigation is required to determine whether some specific corrective action(s) is required and what, if any, that action should be. It might involve an action as recommended by the Board or some alternative action.

We anticipate completing this review and analysis so that a decision as to FAA's course of action can be made within the next 30 days and shall advise the Board of our decision at that time.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 7, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-35

The National Transportation Safety Board's investigation of an incident involving a Piper model PA-31-350, N59911, at Washington National Airport, Washington, D.C., on September 19, 1978, and subsequent monitoring of pertinent Service Difficulty Reports indicate that corrective action is necessary to reduce the possibility of similar occurrences.

Immediately after receiving clearance to taxi out for a scheduled flight to Elmira, New York, the captain of Commuter Airlines Flight 551 taxied forward a short distance for a brake check. Upon brake application, the nose wheel failed and then cocked against the gear fork assembly. This resulted in damage to the gear retract mechanism and subsequent collapse of the nose gear assembly.

Investigation revealed that the nose wheel, Cleveland P/N 40-76B, had failed in fatigue. The fatigue began from multiple origins adjacent to the holes of three bolts which hold the rim to the wheel. The fatigue area covered about 50 percent of the fracture surface and propagated circumferentially from the multiple origins. Maintenance records indicated that the nose wheel had been disassembled and visually inspected 8.9 operating hours before the failure.

A survey of the FAA Maintenance Analysis Center Records indicated that 36 cracked or failed nose wheel assemblies have been reported over the last 5 years. Six of the reported cases involved the Cleveland P/N 40-120A wheel installed on Piper PA-31T model aircraft; the remaining reports involved the Cleveland P/N 40-76B wheel installed on various models of the PA-31 series aircraft.

We recognize that the Federal Aviation Administration has been active in alerting owners and operators of cracks in Cleveland P/N 40-76B wheels installed on Piper PA-31-300 model aircraft and that the information was discussed in the August 1977 issue of FAA's General Aviation Inspection Aids Summary.

2931

On May 9, 1979, Airworthiness Directive 78-12-06 was issued which required a visual inspection of Piper Model PA-31T aircraft nose wheel assemblies, Cleveland P/N 40-120A (Piper P/N 551-778), before each flight. This inspection may be accomplished by the pilot. However, the possibility of a nose wheel failure on other Piper PA-31 series aircraft equipped with the P/N 40-76B nose wheel continues to exist. Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Amend Airworthiness Directive 78-12-06 to require periodic nondestructive inspections of Cleveland P/N 40-76B and P/N 40-120A nose wheels on Piper model PA-31 aircraft. (Class II, Priority Action) (A-80-35)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Thank you for your letter dated April 24, 1981, further responding to National Transportation Safety Board Safety Recommendations A-80-42 and -43 issued May 27, 1980. These are two of three recommendations that stemmed from our investigation of a deHavilland DHC-6-200 accident at Rockland, Maine, on May 30, 1979. The aircraft crashed during a nonprecision instrument approach in instrument meteorological conditions. Companion Safety Recommendation A-80-41 is maintained in an "Open--Acceptable Action" status awaiting your further action and is not the subject of this letter.

In your response to Safety Recommendations A-80-42 and -43, we note you propose to place greater emphasis on crew coordination in related advisory circulars (AC) and handbook materials and to revise AC 135-3B. In consideration of your intended actions, we are classifying these two recommendations in an "Open--Acceptable Alternate Action" status pending your further actions and revision of AC 135-3B.

Sincerely yours,

James B. King
Chairman

Th X.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

April 24, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, DC 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-80-41 through A-80-43 issued May 27, 1980, and supplements our letter of August 20, 1980. This also responds to your letter of January 8, 1981. In that letter, we were informed that Safety Recommendation A-80-41 is classified as "Open—Acceptable Action," and Safety Recommendations A-80-42 and 43 are classified as "Open—Unacceptable Action." This response addresses Safety Recommendations A-80-42 and 43.

A-80-42. Require that 14 CFR 135 operators emphasize crew coordination during recurrent training, especially when pilots are qualified for both single-pilot/autopilot and two-pilot operations. These requirements should be outlined in an operator's approved training curriculum.

A-80-43. Upgrade flight operations manuals of 14 CFR 135 operators to assure standardization by clearly delineating operational duties and responsibilities of all required cockpit crewmembers.

FAA Comment. As stated in our letter of August 20, 1980, we believe that current regulatory provisions exist for crew coordination, including adequate training procedures. In reviewing related advisory circulars and handbook material, however, we believe that additional emphasis could be placed on crew coordination in these publications. Conversely, we do not believe that a regulatory change is required. With these provisions in mind, we propose the following:

1. Revise AC 135-3B, Air Taxi Operators and Commercial Operators, as follows:

74. REGULATORY PROVISIONS. The following rules pertain to Air Taxi and Commercial Operators training programs:

7ГС

a. Section 135.329: Crewmember Training Requirements. The requirements of this section apply to all crewmembers; e.g., pilots-in-command, seconds-in-command, and flight attendants. The basic indoctrination provisions are to be applied to all newly-hired crewmembers, regardless of previous experience, and such requirement should be expressly included in the training program. For operation with more than one pilot, crew coordination procedures are to be emphasized in all phases of flight. As such, in-flight operational duties and responsibilities will be clearly delineated in both the pertinent parts of the training program and the company manual. Such training should be given in each make and model of aircraft flown. Strict adherence to aircraft checklist items will be stressed in all cases.

APPENDIX 1. EXAMPLE - PILOT TRAINING PROGRAM
(COMPANY NAME) (INITIAL AND RECURRENT)

FLIGHT TRAINING (page 8 of Appendix 1)

Flight training standards in practical skills and techniques will be as set forth in Federal Aviation Regulations Part 61 and related advisory circulars for the pilot certificate held, and for the category, class, and type of aircraft the pilot is to operate with the added requirement that the outcome of the maneuver is never in doubt. For operations with more than one pilot, crew coordination procedures are to be emphasized in all phases of flight. Items followed by (S) may be accomplished in an aircraft simulator, (T) a training device.

2. Revise Order 8430.1B, Inspection and Surveillance Procedures - Air Taxi Operators/Commuter Air Carriers and Commercial Operators.

99. REGULATORY PROVISION. The following rules pertain specifically to ATCO training programs.

a. Section 135.329: Crewmember Training Requirements. (Same exact paragraph as above in paragraph 74.)

We believe that this action will satisfy the intent of Safety Recommendations A-80-42 and 43. Accordingly, the Federal Aviation Administration considers action on these recommendations completed.

Sincerely,

J. Lynn Helms
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

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80500516

AOA#: 10

ACTION INFORMATION: ASF-1

DUE DATE(S): 2/24/80

FOR SIGNATURE OF:

COORDINATION WITH/THRU:

INFORMATION COPY: AVS-1/ADF-1

ADA-1

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter of August 20, 1980, responding to National Transportation Safety Board Safety Recommendations A-80-41 through 43 issued May 27, 1980. These recommendations stemmed from our investigation of a deHavilland DHC-6-200 accident at Rockland, Maine, on May 30, 1979. The aircraft crashed during a nonprecision instrument approach in instrument meteorological conditions.

In Safety Recommendation A-80-41, we recommended that the Federal Aviation Administration (FAA):

> "Publish a Maintenance Bulletin to alert Federal Aviation Administration maintenance inspectors to the safety hazard associated with installation of mixed-color cockpit instrument lighting. The bulletin should require that the practice of installing mixed-color lighting be discontinued and that, where this practice has been implemented in the past, the lighting be changed to a uniform configuration."

We are pleased to note that the FAA agrees with this recommendation and is preparing a Maintenance Bulletin. The status of this recommendation is classified as "Open--Acceptable Action."

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OFFICE OF THE ADMINISTRATOR
FEDERAL AVIATION ADMINISTRATION

In Safety Recommendation A-80-42, we recommended that the FAA:

> "Require that 14 CFR 135 operators emphasize crew coordination during recurrent training, especially when pilots are qualified for both single-pilot/autopilot and two-pilot operations. These requirements should be outlined in an operator's approved training curriculum."

We have examined Federal Aviation Regulation (FAR) Section 135.329(e), and we do not agree that this regulatory requirement satisfies the recommendation. The recommendation refers to crew coordination during recurrent training, especially when pilots are qualified in both single-pilot/autopilot and two-pilot operations. While the cited FAR addresses

proficiency in these areas, it does not specifically enunciate a policy emphasizing crew coordination. We believe that Section 135.329(e) should be amended by adding a paragraph which would require that crew coordination training be outlined in the operator's training manual for each aircraft type, model, and configuration which requires two pilots. Pending FAA reconsideration, Safety Recommendation A-80-42 will be classified "Open--Unacceptable Action."

In Safety Recommendation A-80-43, we recommended that the FAA:

> "Upgrade flight operations manuals of 14 CFR 135 operators to assure standardization by clearly delineating operational duties and responsibilities of all required cockpit crew-members."

We have examined the new FAA Order 8430.1B, page 125, paragraph 111, dated January 29, 1980, and we find this an inadequate response to our recommendation. Although the accident occurred during an instrument flight rules (IFR) approach, our recommendation was directed to all phases of flight wherein crew coordination is a necessary part of the flightcrew's function. This includes operations other than IFR.

In our opinion, FAA Order 8430.1B, as revised, should be amended to require that FAA inspectors monitor crew activities throughout the flight to insure specifically that standardization and crew coordination are an integral part of all phases of flight. Pending FAA reconsider-ation, Safety Recommendation A-80-43 will be classified "Open--Unacceptable Action."

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

August 20, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-41 through 43 issued by the Board on May 27, 1980. These recommendations resulted from the Board's investigation of the crash of N68DE, a deHavilland DHC-6-200, at the Knox County Regional Airport, Rockland, Maine, on May 30, 1979. Fifteen passengers and both pilots were killed; one passenger was seriously injured. Following its investigation of the accident, the Safety Board concluded that the flightcrew deviated from standard instrument approach procedures and allowed the aircraft to descend below the published minimum decision height, without the runway environment in sight. The accident occurred during a night nonprecision instrument approach.

As a result of investigation of this accident, the Board expressed concern in two areas: maintenance practices and operational factors. Accordingly, the National Transportation Safety Board (NTSB) recommended that the Federal Aviation Administration (FAA):

A-80-41. Publish a Maintenance Bulletin to alert FAA maintenance inspectors to the safety hazard associated with installation of mixed-color cockpit instrument lighting. The bulletin should require that the practice of installing mixed-color lighting be discontinued and that, where this practice has been implemented in the past, the lighting be changed to a uniform configuration.

Comment. The FAA concurs with Safety Recommendation A-80-41 and a maintenance bulletin concerning this recommendation is being prepared. A copy will be forwarded to your office upon issuance.

A-80-42. Require that 14 CFR 135 operators emphasize crew coordination during recurrent training, especially when pilots are qualified for both single-pilot/autopilot and two-pilot operations. These requirements should be outlined in an operators's approved training curriculum.

Comment. Section 135.329 of the FAR, entitled, "Crewmember training requirements," does in fact include provisions which, in our opinion, will result in effective crew coordination. Paragraph (e) of that section states:

"(e) In addition to initial, transition, upgrade and recurrent training, each training program must provide ground and flight training, instruction, and practice necessary to ensure that each crewmember:

(1) Remain adequately trained and currently proficient for each aircraft, crewmember position, and type of operation in which the crewmember serves; and...."

We believe this regulatory requirement adequately satisfies Recommendation A-80-42 and, accordingly, FAA considers action on this recommendation completed.

A-80-43. Upgrade operations manuals of 14 CFR 135 operators to assure standardization by clearly delineating operational duties and responsibilities of all required cockpit crewmembers.

Comment. Similarly, we believe the vehicle to ensure standardization is the operator's training program. Flight manuals currently specify crew duties, but are not considered an appropriate vehicle for imparting the concept of crew coordination. We direct your attention to Order 8430.1B, Inspection and Surveillance Procedures Air Taxi Operators/Commuter Air Carriers and Commercial Operators. Paragraph 111 of this order, entitled, "Altitude Awareness and Flightcrew Procedures During Instrument Approaches" (copy of applicable portion enclosed), speaks specifically to cockpit vigilance during instrument approach operations. FAA inspectors are required to ensure that these provisions are included in operators' training programs.

We believe the preceding action will correct the deficiencies cited in NTSB Safety Recommendation A-80-43 and, accordingly, FAA considers action on this recommendation completed.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

Enclosure

111. ALTITUDE AWARENESS AND FLIGHTCREW PROCEDURES DURING INSTRUMENT APPROACHES.

a. Two recent fatal crashes during instrument approach operations highlight a need to place special emphasis on altitude awareness and flightcrew vigilance procedures during all phases of the approach.

b. Accordingly, crew coordination procedures shall include a system of altitude callout by the nonflying pilot during all instrument approaches. Additionally, it is recognized that altitude awareness and cockpit vigilance must also be stressed to single-pilot operators. Therefore, single-pilot IFR techniques and training shall also be developed and implemented.

c. Flight Standards inspectors shall ensure that the subject of altitude awareness and cockpit vigilance is included in air taxi operator's pilot training programs, giving special emphasis on all flight checks including those administered by check airmen. This requirement equally applies to one- and two-pilot operations. Special emphasis on these procedures should also be given during inspector contact with check airmen.

d. Another co-related item to be emphasized is cockpit distractions during critical regimes of flight. Periods of "cockpit sterilization" are recommended during which the flight deck crew would not be disturbed by irrelevant communications with ATC or company, calls from flight attendants, or unnecessary conversations in the cockpit. The following is an example of what is considered acceptable for inclusion in an ATCO training program (See Appendix 1, Part Two, Item 7):

(1) A review of instrument approach plates prior to final approach fix to include:

(a) Field elevation;

(b) Type of approach;

(c) Radio configuration;

(d) Minimum descent altitude (MDA) or decision height (DH);

(e) Missed approach procedure; and

(f) Approach speed;

(2) Completion of final checklist prior to or as soon as practicable after final approach fix.

(3) For two-pilot operations during final approach, the nonflying pilot shall check and call out as appropriate:

(a) Final fix inbound or 1000 feet above airport altitude for altimeter and instrument cross-check and flag warnings. During flight director or autocoupler approach, both pilots shall confirm proper flight director autocoupler mode and glide slope lock-on as appropriate. Raw ILS data shall be monitored during approach and significant excursions called out by the nonflying pilot.

(b) Five hundred feet above field elevation cross-check of altimeters, instruments, and flag warnings. Thereafter, the nonflying pilot shall call out significant deviations from planned approach speed, rate of descent, and instrument indications.

(c) One hundred feet above MDA or DH.

(d) MDA or DH.

(e) Approach, strobe, or centerline lights "in sight," or "runway in sight," or "no runway in sight,". No nonstandard sighting callouts should be made.

(f) During nonprecision approaches, the altitude callouts at minimum descent altitude shall be continued while maintaining the MDA:

(1) Until the aircraft reaches the missed approach point; or

(2) Until the pilot can maintain visual reference for landing as required by FAR 91.117; or

(3) Until a missed approach procedure is commenced and positive rate of climb is established.

(g) During the conduct of ASR approaches, the nonflying pilot shall confirm to the pilot flying the airplane all "should be" altitudes given by the ASR final controller. Special emphasis should be made of the necessity to have the nonflying pilot report significant rate of descent excursions continually until the aircraft is visual and over the runway. Finally, a critical item which needs to be emphasized to flightcrews is the importance of stage III pilot responsibilities, and the contents of Advisory Circular 90-48A, Pilots' Role in Collision Avoidance, particularly in the use of proper visual scanning techniques.

112. AIR TAXI WINTER OPERATIONS.

a. It is essential for air taxi operators and commercial operators to have effective programs (both training and operational) to minimize incidents and accidents associated with winter operations. Experience has shown that each winter a number of incidents and/or accidents usually occur as a result of cold weather operations of aircraft.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 27, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-41 through -43

At about 2100 e.d.t., on May 30, 1979, N68DE, a deHavilland DHC-6-200, owned and operated by Downeast Airlines, Inc., crashed on approach to runway 3 at the Knox County Regional Airport, Rockland, Maine. Fifteen passengers and both pilots were killed; one passenger was seriously injured. Following its investigation of the accident, the Safety Board concluded that the flightcrew deviated from standard instrument approach procedures and allowed the aircraft to descend below the published minimum decision height, without the runway environment in sight. The accident occurred during a night nonprecision instrument approach. 1/ The Safety Board's investigation of this accident disclosed two areas of concern: one in maintenance practices and the other in operational factors.

In the area of maintenance factors it was found that there was a potentially hazardous situation regarding cockpit instrument lighting. Pilots who had flown the aircraft involved in the accident testified that the cockpit instrument lighting was poor. The cockpit lights had to be kept dim to prevent windshield/window glare, and there was a mixture of red and white light bulbs in the center instrument panel. Thus, if the rheostat was set low enough to eliminate glare from the white lights, the red bulbs did not provide enough light to properly illuminate the instrument in which they were installed. This problem was the result of a maintenance practice which allowed maintenance personnel to replace burned out light bulbs with new bulbs of either color. With this combination of white and red bulbs, the pilots were forced to choose between setting the white lights at a level that would allow them to read all the instruments, with the resulting glare and possible loss of night vision, or at a lower setting where the white lights did not cause glare but instruments would be unreadable.

In the operational factors investigation it was disclosed that there was a lack of standardized procedures for cockpit management and for two-pilot crew coordination at Downeast Airlines. The only procedures outlined in the company flight manual for the

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1/ For more detailed information, read "Aviation Accident Report—Downeast Airlines, Inc., deHavilland DHC-6-200, N68DE, Rockland, Maine, May 30, 1979" (NTSB-AAR-80-5).

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copilot were to maintain aircraft cleanliness, assure passenger comfort, and perform other duties as commanded by the captain. Consequently, there was neither clear delineation of responsibilities or workload in the cockpit nor procedural standardization among captains. The first officers' duties varied at the discretion of each captain.

The captain and first officer of the accident aircraft were qualified for single-pilot/autopilot operations in Piper Navajo aircraft, and for two-pilot operations in deHavilland DHC-6-200 aircraft. When a flightcrew is dual-qualified in this manner, and pilots frequently shift from one aircraft to the other, a clear delineation of duties and responsibilities when operating in the two-pilot crew environment is essential. Otherwise, the safety advantages inherent in the two-pilot crew concept are negated.

The Safety Board concludes that both areas of concern pose potential hazard to the safe operation of any flight. Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Publish a Maintenance Bulletin to alert Federal Aviation Administration maintenance inspectors to the safety hazard associated with installation of mixed-color cockpit instrument lighting. The bulletin should require that the practice of installing mixed-color lighting be discontinued and that, where this practice has been implemented in the past, the lighting be changed to a uniform configuration. (Class II, Priority Action) (A-80-41)
>
> Require that 14 CFR 135 operators emphasize crew coordination during recurrent training, especially when pilots are qualified for both single-pilot/ autopilot and two-pilot operations. These requirements should be outlined in an operator's approved training curriculum. (Class II, Priority Action) (A-80-42)
>
> Upgrade flight operations manuals of 14 CFR 135 operators to assure standardization by clearly delineating operational duties and responsibilities of all required cockpit crewmembers. (Class II, Priority Action) (A-80-43)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

James B. King

By: James B. King
Chairman

US Department
of Transportation
**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

June 16, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to your letter of April 17, 1981, concerning the status of the study of bird strike history and heated windshield design, as cited in our reply of August 26, 1980, to NTSB Safety Recommendation A-80-44.

A-80-44. Conduct a study to determine whether the structural characteristics of general aviation aircraft windscreens equipped with heating elements are enhanced by the use of such elements and apprise operators of optimal procedures through inclusion in appropriate flight manuals or issuance of an advisory circular.

FAA Comment. In our letter of August 26, 1980, we informed the Board that a study of general aviation and commuter airplane accidents was being initiated. This is to inform you that the Federal Aviation Administration has now authorized a research project to study general aviation and commuter accidents and incidents. This study will evaluate bird strike history and review windshield designs in these airplanes in an effort to determine the effect of windshield heat on windshield structural strength. We began work on this project June 1, 1981, and the Board will be informed of significant progress as our efforts continue in this area.

Sincerely,

J. Lynn Helms
Administrator

National Transportation Safety Board
Washington, D.C. 20594

Office of the Chairman

APR 17 1981

Honorable J. Lynn Helms
Administrator Designate
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Reference is made to National Transportation Safety Board Safety Recommendation A-80-44 issued May 28, 1980. This recommendation pertains to windscreen bird strikes on Beech B-99 and similar aircraft. We recommended that the Federal Aviation Administration (FAA):

> "Conduct a study to determine whether the structural characteristics of general aviation aircraft windscreens equipped with heating elements are enhanced by the use of such elements and apprise operators of optimal procedures through inclusion in appropriate flight manuals or issuance of an advisory circular."

The FAA's response of August 26, 1980, indicated that the FAA would evaluate bird strike history and, as part of this project, review windshield designs. We were advised to expect a progress report on or about January 1, 1981. We acknowledged this letter on September 17, 1980. We have not yet received the progress report and our concern is renewed because of a recent accident.

On April 7, 1981, an Executive Aviation Learjet 23 on takeoff from Lunken Airport, Cincinnati, Ohio, was struck by a bird on the right windscreen. The bird penetrated the windscreen, resulting in fatal injuries to the copilot and minor injuries to the pilot. Because of the continuing potentially hazardous condition existing with aircraft certificated under Federal Aviation Regulation Part 23, some with high performance characteristics, the Safety Board would appreciate an expedited status report of the FAA's research into windshield design.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

September 25, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue
Washington, D.C. 20594

Dear Mr. Chairman:

This acknowledges receipt of NTSB Safety Recommendations A-80-53 through 55, delivered by the Board on Friday, June 27, 1980, at 5:40 p.m., after close of official business. These recommendations were based on the Board's investigations of accidents involving Series 20 Learjet aircraft in the low-speed landing configuration and high-speed, high-altitude cruise environment.

The Federal Aviation Administration (FAA) is aware of the facts cited by the Board in its June 27 transmittal letter and has aggressively pursued corrective actions relative to these problems. A review of the accident data pertaining to these aircraft was initiated immediately following the May 6 accident at Richmond. On June 9, 1980, the Safety Analysis Division, Office of Aviation Safety submitted an analysis of Learjet accidents and Service Difficulty Reports to the Air Transportation Division, Office of Flight Operations. The analysis indicated a need for reevaluation of Learjet systems and subsystems concerning stick pusher and shaker, autopilot pitch and roll, elevator, aileron and throttle cables.

The analysis determined that aircraft control was involved in approximately 30 percent of the 49 accidents used in the analysis. Aircraft control involved overshoot, undershoot, runway alignment, and flying speed; but pilot flight-hour experience did not appear to be a factor. Based upon the analysis and the information presently available through the accident investigation, we have initiated actions which address the subject of the recommendations as follows.

A-80-53. Convene a Multiple Expert Opinion Team to evaluate the flight characteristics and handling qualities of Series 20 Learjet aircraft, with and without slow flight modification, at both low- and high-speed extremes of the operational flight envelope under the most critical conditions of weight and balance (and other variable factors) and to establish the acceptability of the control and airspeed margins of the aircraft at these extremes.

Comment. This recommendation has already been encompassed in an earlier investigation involving all Learjets, including the Series 20. This investigation was a followup to the February 1979 "Study of Selected Performance Characteristics of Modified Lear Jet Aircraft" in

which the NTSB, FAA, Learjet Corporation, National Aeronautics and Space Administration, and other interested parties participated. As a result of the investigation, Airworthiness Directive (AD) 79-12-05 was issued (copy enclosed). Also, a separate investigation was initiated by the FAA on June 17, 1980, to accomplish a certification review which will also include other areas not specifically addressed in the Board's recommendations. Although this review is still in its initial stages, preliminary information developed as a result of joint FAA and Gates Learjet Corporation flight evaluations has evidenced characteristics at the limits of their operating envelope which in combination with presently approved operating procedures could adversely affect safety of flight. In light of the foregoing, on August 1, the FAA Central Region issued by airmail letter an emergency airworthiness directive (copy enclosed) to Learjet aircraft owners. Since our investigation and review is incomplete, we will make our findings available to the Board when we complete our research.

A-80-54. Advise all Learjet operators of the circumstances of recent accidents and emphasize the prudence of rigid adherence to the specified operational limits and recommended operational procedures.

Comment. Immediately upon receipt of NTSB Safety Recommendation A-80-54, a notice, which included the Board's entire transmission (copy enclosed), was sent to all Learjet operators. In addition, a GENOT was telegraphed to all FAA General Aviation District Offices (GADO's), Flight Standards District Offices (FSDO's) and Air Carrier District Offices (ACDO's), directing that all Learjet Part 91, 121, and 135 operators be contacted to verify that the operators received the notice and were fully aware of the contents of NTSB Safety Recommendation A-80-54.

A-80-55. Evaluate information contained in the Gates Learjet Service News Letter 49 dated May 1980 pertaining to procedures to be followed if the aircraft inadvertently exceeds V_{mo}/M_{mo} and, based on this evaluation, require appropriate revisions to the aircraft flight manual.

Comment. This recommendation is included in FAA's investigation described above in our comments relative to NTSB Safety Recommendation A-80-53. Also, FAA's Office of Flight Operations has established a separate team to review the adequacy and effectiveness of Learjet crew training.

In addition to these actions which are being taken in direct response to NTSB Safety Recommendations A-80-53 through 55, a GENOT (copy enclosed) was also distributed on May 22, 1980, to all GADO's, FSDO's and ACDO's. This GENOT requested the immediate inspection of all Learjet aircraft for installation of mach warning cut-out switches. To date we have noted seven instances of aircraft with unapproved cut-out switch installations, and these all have now been removed.

Finally, on June 2, 1980, a special issue of General Aviation Airworthiness Alerts was published (copy enclosed). This alert addressed the subject of unapproved alterations of speed warning systems in both air carrier and general aviation aircraft.

We will continue to keep the Board informed of our findings as the investigation progresses.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

4 Enclosures

National Transportation Safety Board

Washington, D.C. 20594

Office of Chairman

SEP 17 19..

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Thank you for your letter dated August 26, 1980, responding to National Transportation Safety Board Safety Recommendation A-80-44 issued May 28, 1980. This recommendation stemmed from our investigation of a Beech B-99 accident on April 5, 1979. While the aircraft was descending to land at the Regional Airport in Lafayette, Louisiana, it was struck by a bird which penetrated the windscreen. We recommended that the Federal Aviation Administration (FAA):

> "Conduct a study to determine whether the structural characteristics of general aviation aircraft windscreens equipped with heating elements are enhanced by the use of such elements and apprise operators of optimal procedures through inclusion in appropriate flight manuals or issuance of an advisory circular."

The Safety Board is pleased to note that the FAA has initiated a study to evaluate bird strike history and, as part of this project, will review windshield designs. Safety Recommendation A-80-44 is maintained in an "Open--Acceptable Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

August 26, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-80-44 issued by the Board on May 28, 1980. This recommendation resulted from the Board's investigation of a bird strike to a Royale Airlines Beech B-99 at Lafayette, Louisiana, on April 5, 1979.

A-80-44. Conduct a study to determine whether the structural characteristics of general aviation aircraft windscreens equipped with heating elements are enhanced by the use of such elements and apprise operators of optimal procedures through inclusion in appropriate flight manuals or issuance of an advisory circular.

Comment. The basis for this recommendation cites an instance of bird penetration of a Beech 99 windscreen. The Federal Aviation Administration is initiating a study of general aviation and commuter airplane accidents to evaluate bird strike history. As a part of the effort, we are reviewing windshield designs to determine the feasibility of developing guidelines for the heating of general aviation airplane windshields. We will advise you of our progress in this effort on or about January 1, 1981.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 28, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-44

On April 5, 1979, a Royale Airlines Beech B-99, N1922T, being operated under 14 CFR 135, was struck by a flock of birds while descending for a landing at the Regional Airport in Lafayette, Louisiana. One bird penetrated the right windscreen, resulting in minor injuries to the copilot. There were 2 crewmembers and 13 passengers on board the aircraft. The National Transportation Safety Board's investigation of this incident indicates that corrective action is necessary to reduce the possibility of windscreen penetration in this and similar aircraft.

The Beech 99A windscreen is constructed of two-ply plate glass panels, with a single vinyl material sandwiched in between. The windscreen also incorporates a heating element. Investigation revealed that the flightcrew had not activated the windscreen heat during the descent, and the Flight Operations Manual does not specify the use of windscreen heat when descending. Further, according to the aircraft manufacturer's engineers, the manual does not suggest the use of windscreen heat in an area of high bird strike probability, and no bird strike tests have been conducted on the Model 99 aircraft windscreen since there is no requirement for such tests in 14 CFR Part 23.

At the Safety Board's request, the Federal Aviation Administration queried its computer for Service Difficulty Reports over the last 5 years in which bird strikes were reported. The computer run revealed that about 15 bird strikes have been reported involving general aviation aircraft. These strikes occurred not only on windscreens but on other areas of the aircraft as well.

A query of the Safety Board's accident/incident computer revealed that there were 53 bird strikes reported on all types of general aviation aircraft between 1964 and 1978. During the period, 6 aircraft were destroyed, 45 were damaged substantially, and 2 were damaged slightly. In addition, 5 persons were killed and 115 were injured as a result of these accidents.

The Beech 99 is used primarily in commuter operations, and it is used extensively in operations around coastal regions and at the lower altitudes where exposure to bird strikes is more likely. The Safety Board believes that the windscreens of the Beech 99 and similar aircraft used in commuter and air taxi operations should be tested to determine their tolerance to bird strikes in both the "hot" and "cold" configurations. Bird strike tests on windscreens have been conducted on many types of aircraft in the "heated" versus "cold" configuration, and the heated windscreen was found less susceptible to breakage or penetration. Tests or studies should be conducted to determine which condition offers the best protection in the event of a bird strike. This information should be incorporated into appropriate flight manuals and appropriate procedures should be made a part of the aircraft checklist.

In view of the above, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Conduct a study to deterr [illegible] whether the structural characteristics of general aviation aircraft [illegible]dscreens equipped with heating elements are enhanced by the use of such elements and apprise operators of optimal procedures through inclusion in appropriate flight manuals or issuance of an advisory circular. (Class III, Longer Term Action) (A-80-44)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 26, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to your letter of March 20, 1981, regarding Safety Recommendations A-80-59 and A-80-60. This response will provide an updated status report of the Federal Aviation Administration's (FAA) actions with regard to these safety recommendations.

A-80-59. Revise FAA Handbook 8260.19 to require that separate standardized instrument approach charts be published for all airport approaches that require a sidestep maneuver. These charts should clearly indicate the airport approach plan view, the profile view, and the landing minima required.

NTSB Response to FAA Actions. After reviewing the FAA's October 9, 1980, response to Safety Recommendation A-80-59, the Board stated its continued concern that aircrews can be misled by the sidestep maneuver procedures as they are portrayed on standard United States instrument approach charts. The Board further stated its belief that there was a need for a plan view of the sidestep maneuver on approach charts for clarity purposes. In addition, the Board noted that Jeppesen had revised the Mexico City instrument approach chart indicating the transition to Runway 23R for landing and stated that "This action would be responsive to the Safety Board's expressed concern if it were applied for all charts associated with airports in the United States where the sidestep maneuver is required." Pending the FAA's reconsideration, A-80-59 was classified in an "Open--Unacceptable Action" status.

FAA Comment. We concur with the need to standardize instrument approach charts for all airport approaches that require a sidestep maneuver. Our analysis, however, does not support a need for separate charts (plan view portrayal) for these approaches, and in some locations separate charts

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SUMMARY OF FEDERAL AVIATION ADMINISTRATION RESPONSES TO NATIONA--ETC(U)
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would be highly undesirable due to the great increase in the number of charts that would result. For example, as we noted in our October 9, 1980, response to this recommendation, at the Los Angeles International Airport 8 new charts would be required in addition to the 13 currently published.

The sidestep maneuver to a landing on a parallel runway is similar to, but less complicated than, circling to land on a runway which may be aligned as much as 180° from the final approach course. Charting a plan view for the circling maneuver is difficult, if not impossible. While it is possible to chart a plan view of a sidestep maneuver, we conclude that this is unnecessary and, as noted above, highly undesirable because of the number of additional charts that would result at some locations.

On U.S. Government charts, circling and sidestep minimums are charted below the primary runway straight-in minimums. A pilot selects the appropriate minimums and plans the appropriate maneuver based on his air traffic control clearance. The Air Traffic Service provides very specific clearances for sidestep approaches. An example would be, "cleared for ILS runway 23 left, sidestep to runway 23 right." The word "sidestep," like the word "circle," clearly tells the pilot that his minimums and landing maneuver will be other than straight-in to the runway on which the approac is aligned. The sidestep minimums are presently shown as straight-in to the parallel runway, such as "S-23R." The present U.S. charting and clearance methods have worked well.

As noted in our October 9, 1980, response, we are taking action to identify more clearly the sidestep minimums. Under our recommended change, the word "sidestep" will be used with the runway number instead of the letter "S." This charting change has been presented by the FAA member of the Interagency Cartographic Committee (IACC) to the Member Point of Contact Group (MPOC). The MPOC working group (DOD, FAA, NOS) does not oppose the change. We expect IACC approval and the charting changes to be complete within the next 2 or 3 months. The major commercial aeronautical charting company has indicated they will also use the word "sidestep" in their charted minimums as soon as the new method is adopted. With the adoption of this proposal by the IACC, the FAA will consider action on A-80-59 completed. We will keep the Board informed of IACC's actions.

A-80-60. Publish an Advisory Circular, or amend an existing Advisory Circular, to disseminate information on the sidestep maneuver procedures, terminal ATC communications procedures, radar separation and equipment requirements, and landing minima applicable to the use of the sidestep maneuver by American air carriers at both domestic and foreign airports.

FAA Comment. As noted in our October 9, 1980, response, Advisory Circular 90-1A, Civil Use of U.S. Government Instrument Approach Procedures Charts, will be rewritten to provide the sidestep information. Our original estimated completion date of February 15, 1981, has been extended to June 15, 1981, due to renewed user interest in the overall contents of this advisory circular information and the resultant necessity to rewrite the entire circular. We will provide the Board with an advance copy of Advisory Circular 90-1A when it is ready for publication and will consider action on this safety recommendation complete at that time.

Sincerely,

J. Lynn Helms
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Reference is made to the Federal Aviation Administration's (FAA) letter dated October 9, 1980, responding to National Transportation Safety Board Safety Recommendations A-80-59 and 60 issued July 14, 1980. These recommendations stemmed from our investigation of a Western Airlines, DC-10-10, accident at Mexico City International Airport, Mexico City, Mexico, on October 31, 1979. Although the aircraft was cleared to land by means of a sidestep maneuver to runway 23-R, the crew continued the approach to runway 23-L, which had been closed for repairs.

There are 33 airport runways in the United States that utilize the sidestep maneuver. We recommended standardized instrument approach charts for all approaches that require a sidestep maneuver, and the publication of an Advisory Circular to disseminate information on sidestep maneuver procedures.

We remain concerned that aircrews can be misled by the sidestep maneuver procedures as they are portrayed on standard United States instrument approach charts, and we believe there is a need for a plan view of the sidestep maneuver for clarity. We note that Jeppesen has revised the Mexico City instrument approach chart indicating the transition to runway 23-R for landing. This action would be responsive to the Safety Board's expressed concern if it were applied for all charts associated with airports in the United States where the sidestep maneuver is required. We request that such action be taken for these airports. Pending your reconsideration, A-80-59 is classified in an "Open--Unacceptable Action" status.

We thank the FAA for actions taken and underway to fulfill A-80-60 which we are maintaining in an "Open--Acceptable Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

October 9, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-59 and 80-60 issued by the Board on July 14, 1980. These recommendations resulted from the Board's investigation of the crash of a Western Airlines McDonnell Douglas DC-10-10 at Mexico City International Airport on October 31, 1979.

A-80-59.

Revise FAA Handbook 8260.19 to require that separate standardized instrument approach charts be published for all airport approaches that require a sidestep maneuver. These charts should clearly indicate the airport approach plan view, the profile view, and the landing minima required.

Comment.

We do not concur with a requirement for separate charting of all instrument approaches that require sidestep manuevers. Our rationale for nonconcurrence is as follows:

A sidestep maneuver (to a landing on a parallel runway) is similar to a circling maneuver in that an aircraft utilizes a NAVAID aligned to one runway and when in visual conditions maneuvers to land on another. As such, the sidestep minimums are published on the chart along with straight-in minimums for the primary runway and circling minimums. In the U.S., when an aircraft is cleared for a particular approach, the pilot is advised by air traffic control (ATC) if he is to sidestep or circle to land at the conclusion of the approach. The pilot then selects the landing minimums appropriate for his clearance. A separate instrument approach chart of the sidestep maneuver is not warranted and might be a hindrance. At Los Angeles International Airport, for

example, eight new charts would be required in addition to the 13 there now. The pilot must understand his ATC clearance if he is to select the sidestep minimums on the present combined charts. We believe this requirement is preferable to selecting the proper page if sidesteps were charted separately.

Present U.S. Government charts show sidestep landing minimums as straight-in to a parallel runway. The identification is "S-" followed by the runway number. Our Aircraft Programs Division has initiated action to substitute the word "sidestep" where appropriate. The principal American commercial aeronautical charting company has indicated it will do the same and, in addition, will eliminate presenting the sidestep minimums as a note.

A-80-60.

Publish an Advisory Circular, or amend an existing Advisory Circular, to disseminate information on the sidestep maneuver procedures, terminal ATC communication procedures, radar separation and equipment requirements, and landing minima applicable to the use of the sidestep maneuver by American air carriers at both domestic and foreign airports.

Comment.

The *Airman's Information Manual* describes the sidestep maneuver, the relevant ATC communications, and sidestep landing minimums in paragraphs 380 and 381. However, Advisory Circular 90-1A, Civil Use of U.S. Government Instrument Approach Procedure Charts will be rewritten to provide the sidestep information. Once this rewrite is completed, FAA believes this action corrects the deficiencies which were of concern to the Board in Safety Recommendations A-80-59 and 60.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

REVISED: AUGUST 21, 1980 ISSUED: July 14, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-59 and -60

On October 31, 1979, Western Airlines, Inc., McDonnell Douglas DC-10-10, N-903WA, crashed at Mexico City International Airport, Mexico. Although the aircraft was cleared for a Tepexpan arrival and was advised that the landing runway was 23R, the crew continued the approach to runway 23L, which had been closed for repairs. The aircraft struck heavy equipment on runway 23L as the crew attempted to execute a missed approach. Of the 76 passengers and 13 crewmembers aboard, 61 passengers and 11 crewmembers were fatally injured, and 13 passengers and 2 crewmembers were seriously injured. One person on the ground was fatally injured.

The crew was advised on at least four occasions by either Mexico City Air Route Traffic Control Center or the tower that they were to land on runway 23R. However, none of these air traffic control (ATC) communications contained phraseology similar to that used in United States ATC communications regarding a sidestep maneuver. 1/ The investigation revealed that both pilots knew that runway 23L was closed and that each had landed aircraft at the airport while the runway was closed.

The Safety Board believes that a good graphic presentation of the sidestep maneuver on the approach chart would have aided the crew. Nowhere on standard United States' approach charts is the complete maneuver portrayed, nor is the word "sidestep" shown. The procedure is shown as a straight-in approach to an adjacent runway, as a circling approach to the sidestep runway, or as a note at the bottom of the chart giving ceiling and visibility minima. In the accident case, the Mexico City chart for runway 23 right contained only ceiling and visibility minima.

1/ A visual alignment maneuver required of a pilot executing an approach to one runway while cleared to land on a parallel runway.

2936A

The Safety Board believes that a separate instrument approach chart is needed for the 33 airport runways that utilize the sidestep maneuver in the United States. In addition, we believe there is a need to publish more information on sidestep maneuver procedures.

Accordingly, the Safety Board recommends that the Federal Aviation Administration:

> Revise FAA Handbook 8260.19 to require that separate standardized instrument approach charts be published for all airport approaches that require a sidestep maneuver. These charts should clearly indicate the airport approach plan view, the profile view, and the landing minima required. (Class II, Priority Action) (A-80-59)
>
> Publish an Advisory Circular, or amend an existing Advisory Circular, to disseminate information on the sidestep maneuver procedures, terminal ATC communication procedures, radar separation and equipment requirements, and landing minima applicable to the use of the sidestep maneuver by American air carriers at both domestic and foreign airports. (Class I, Urgent Action) (A-80-60)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

Patricia Bursley

for By: James B. King
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

JUN 26 [illegible]

Honorable J. Lynn Helms
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Helms:

Thank you for your letter dated May 26, 1981, further responding to National Transportation Safety Board Safety Recommendations A-80-61 and A-80-62 issued July 21, 1980. These are two of three recommendations that stemmed from our investigation of a Beech B95 fire accident at Tulsa, Oklahoma, on April 8, 1980, and a Beech B58 fire accident at Casper, Wyoming, on May 16, 1980. Companion Safety Recommendation A-80-63 was classified "Closed--Acceptable Action" on December 19, 1980.

In A-80-61, we asked the Federal Aviation Administration (FAA) to require a one-time inspection of those aircraft that have been inspected in accordance with the requirements of Airworthiness Directive (AD) 78-05-06 to ensure the integrity of the fuel vent system. In A-80-62, we recommended that the FAA immediately amend AD 78-05-06 to include a procedure that will assure vent system integrity following the inspection required by the AD. In our letter of December 19, 1980, we informed the FAA that we were maintaining the two recommendations in an "Open--Acceptable Alternate Action" status pending the issuance of a maintenance alert advising mechanics who are responsible for compliance with AD 78-05-06 to use caution and follow the instructions set forth in the AD. We note that Advisory Circular No. 43-16, General Aviation Airworthiness Alert No. 29 of December 1980, was subsequently issued to fulfill the intent of both recommendations. Safety Recommendations A-80-61 and A-80-62 are now classified in a "Closed--Acceptable Alternate Action" status.

We thank the FAA for actions taken.

Sincerely yours,

James B. King
Chairman

U.S. Department
of Transportation
Federal Aviation
Administration

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

May 26, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-80-61 and A-80-62 issued July 21, 1980, and supplements our letter of October 17, 1980. These recommendations were issued as a result of the Board's investigation of two similar accidents involving explosion and fire in aircraft wings during engine start. A third recommendation, A-80-63, was also issued and was classified in a "Closed--Acceptable Action" status by NTSB letter dated December 19, 1980.

A-80-61. Require a one-time inspection of those aircraft that have been inspected in accordance with the requirements of Airworthiness Directive 78-05-06, to ensure the integrity of the fuel vent system.

A-80-62. Amend immediately Airworthiness Directive 78-05-06 to include a procedure which will assure vent system integrity following the inspection required by the airworthiness directive.

FAA Comment. As stated in our letter of October 17, 1980, the alert on Goodyear Aerospace Corporation fuel cells, BTC-39 series construction type, was published in General Aviation Airworthiness Alert No. 29, AC No. 43-16, dated December 1980.

A copy of this alert was forwarded to your staff on December 18, 1980. Apparently the document arrived too late to be addressed in your letter of December 19, 1980, which classified these two recommendations in an "Open--Acceptable Alternate Action" status pending implementation of the alert publication. Enclosed is a copy of the alert and the Federal Aviation Administration considers action completed on Recommendations A-80-61 and 62.

Sincerely,

J. Lynn Helms
Administrator

Enclosure

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Bond:

Reference is made to your letter of October 17, 1980, responding to National Transportation Safety Board Safety Recommendations A-80-61 through 63 issued July 21, 1980. These recommendations stemmed from our investigation of a Beech B95 fire accident at Tulsa, Oklahoma, on April 8, 1980, and a Beech B58 fire accident at Casper, Wyoming, on May 16, 1980.

Both accidents occurred on the ground while the engines were being started, causing fire and explosions in the wing areas. Investigation revealed that in both cases the fuel vent lines were disconnected at the B-nut fittings inside the wings. Inspection of another Beech 95 revealed that the vent line was disconnected at a B-nut fitting. Our concern that these unsafe conditions could lead to fire in flight led to the recommendations regarding Airworthiness Directive (AD) 78-05-06 and Beech Aircraft Corporation Service Instruction No. 0895.

In A-80-61, we asked the Federal Aviation Administration (FAA) to require a one-time inspection of those aircraft that have been inspected in accordance with the requirements of AD 78-05-06 to ensure the integrity of the fuel vent system. In A-80-62, we recommended that the FAA immediately amend AD 78-05-06 to include a procedure that will assure vent system integrity following the inspection required by the AD. We note that the FAA intends to fulfill the intent of these two recommendations by issuing a maintenance alert advising mechanics who are responsible for compliance with AD 78-05-06 to use caution and follow the instructions set forth in the AD. We have examined the wording of the proposed alert and believe that this alternative action when implemented will fulfill the intent of these two recommendations, which we have classified in an "Open--Acceptable Alternate Action" status.

In A-80-63, we asked the FAA to require the Beech Aircraft Corporation to amend Service Instruction No. 0895 to advise all operators of Model B58 and Model B95 airplanes of the possible unsafe condition and to specify a procedure which will assure that the vent system integrity is restored following fuel tank inspection. In view of the FAA's assurance that AD 78-05-06 satisfies the intent of this recommendation and that there is no need for the Beech Aircraft Corporation to amend Service Instruction No. 0895, we are classifying A-80-63 "Closed--Reconsidered."

Sincerely yours,

James B. King

James B. King
Chairman

D:PARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

October 17, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-61 through -63 issued by the Board on July 21, 1980. These recommendations resulted from the Board's investigation of two similar accidents which involved explosion and fire in an aircraft wing during engine start. Both occurred in similar Beech airplanes, a Model B58 and a Model B95.

A-80-61.

Require a one-time inspection of those aircraft that have been inspected in accordance with the requirements of Airworthiness Directive 78-05-06, to ensure the integrity of the fuel vent system.

A-80-62.

Amend immediately Airworthiness Directive 78-05-06 to include a procedure that will assure vent system integrity following the inspection required by the Airworthiness Directive.

Comment.

We do not believe an Airworthiness Directive (AD) for a one-time maintenance inspection is necessary to assure that a mechanic has adequately completed an inspection that is already required by an AD. AD 78-05-06 does not relate to the integrity of the vent system, and any vent system integrity check would be a maintenance inspection item. Assuming the mechanic complies with the procedures set forth in the AD, there should be no problems with the repair procedures as outlined. However, since vent lines may have been improperly disconnected in demonstrating compliance with AD 78-05-06, we intend to issue the

following maintenance alert advising mechanics who are responsible for compliance with AD 78-05-06 to use caution and follow instructions as set forth in the AD:

> GOODYEAR AEROSPACE CORPORATION
>
> Fuel Cells, BTC-39 series construction type.
>
> AD 78-05-06 requires inspections of those fuel cells to determine integrity. There is evidence that some maintenance facilities accomplishing this AD may have improperly disconnected vent lines within the wings and failed to reconnect them. This of course can easily lead to fuel leakage within the wings and potential hazards. Maintenance facilities are urged to assure the integrity and continuity of all fuel systems at any time work on inspections are performed. They may wish to reevaluate their procedures on any aircraft on which they have accomplished this AD.

A-80-63.

Require that the Beech Aircraft Corporation amend Service Instruction No. 0895 to advise all operators of these airplanes of the possible unsafe condition, and to specify a procedure which will assure that the vent system integrity is restored following fuel tank inspection.

Comment:

The Beech Service Instruction referenced in Recommendation A-80-63 was issued by Beech at our request and incorporated in the AD as an alternate means of compliance. The FAA does not have the authority to require the Beech Aircraft Corporation to amend their Service Instructions. Of course, if a safety hazard is determined to arise out of compliance with a manufacturer's Service Instructions, we will issue an Airworthiness Directive. However, we see no need for the Beech Aircraft Corporation to amend Service Instruction No. 0895 to specify a procedure which will assure that the vent system integrity is restored following fuel tank inspection. In FAA AD 78-05-06 we state ". . . reconnect fuel cell and fuel system, and access covers, and functionally pressure check fuel system in accordance with aircraft manufacturer's service data or item (c). . . . ." We feel this statement satisfies the Board's recommendation.

FAA considers action on Safety Recommendations A-80-61 through -63 completed.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 21, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-61 through -63

The National Transportation Safety Board has recently investigated two similar accidents which involved explosion and fire in an aircraft wing during engine start. Both occurred in similar Beech airplanes, a Model B58 and a Model B95. Although both occurred on the ground and no injuries resulted, the Board has determined that the unsafe condition which caused the fires could lead to fire in flight.

Our investigations of the April 8, 1980, Beechcraft 95 fire at Tulsa, Oklahoma, and the May 16, 1980, Beechcraft B58 fire at Casper, Wyoming, revealed that in both cases the fuel vent lines were disconnected at B-nut fittings inside the wings.

When the fuel tank is full and the fuel expands, the pressure relief valve allows the expanded fuel and vapors to be expelled overboard through the vent line. When the vent line is disconnected, the fuel will be vented into the interior of the wing and flow inboard toward the engine nacelle because of the wing dihedral. When the fuel reaches the nacelle, it can be ignited by hot engine parts or engine exhaust. Our investigations confirmed that both fires began in this manner. In addition, one other Beechcraft Model 95 was inspected and found to have the vent line disconnected at a B-nut fitting.

On all three aircraft, the fuel tank inspection and leak test required by Airworthiness Directive 78-05-06 had been accomplished a few days before the discovery of the disconnected vent lines. The airworthiness directive requires that the inspection be accomplished in accordance with the manufacturer's instructions. For these aircraft the appropriate document is Beechcraft Service Instruction No. 0895, Revision 1. This Service Instruction states: "plug all pressure relief vents (if equipped) and recessed vents. . . ." The method of plugging these vents is left to the discretion of the person conducting the inspection. It appears that, rather than plugging the vent outlets, the vent lines are being disconnected and fitted with plugs. In the cases cited here it appears the plugs were removed but the vent lines were not properly reconnected. The service instruction procedure does not have specific steps for restoring the system to its original configuration.

Since the inspection applies to many aircraft, the Safety Board is concerned that the unsafe condition described above could exist in other aircraft and that the condition may recur after future inspections. Therefore, the Safety Board recommends that the Federal Aviation Administration:

> Require a one-time inspection of those aircraft that have been inspected in accordance with the requirements of Airworthiness Directive 78-05-06, to ensure the integrity of the fuel vent system. (Class I, Urgent Action) (A-80-61)
>
> Amend immediately Airworthiness Directive 78-05-06 to include a procedure which will assure vent system integrity following the inspection required by the airworthiness directive. (Class II, Priority Action) (A-80-62)
>
> Require that the Beech Aircraft Corporation amend Service Instruction No. 0895 to advise all operators of these airplanes of the possible unsafe condition, and to specify a procedure which will assure that the vent system integrity is restored following fuel tank inspection. (Class II, Priority Action) (A-80-63)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 11, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-80-101 through A-80-104 issued September 25, 1980, and supplements our letter of December 15, 1980. This will provide a current status report on the weather-related recommendations A-80-101, -103, and -104, and also responds to your letter of March 26, 1981. In that letter, you also requested the Federal Aviation Administration (FAA) to reconsider Safety Recommendation A-80-102, which is being maintained in an "Open--Unacceptable Action" status.

A-80-101. Evaluate, in cooperation with the State of Alaska and the National Weather Service, the feasibility of equipping its flight service stations and the NWS-certified weather observers in rural villages with high-frequency transceivers that have the appropriate frequencies to facilitate the ground-to-ground communication of weather and runway conditions.

FAA Comment. As stated in our letter of December 15, 1980, the FAA's Alaskan Region is presently using high-frequency (HF) transceivers to collect weather and airport information from remote locations. We plan to provide HF transceivers as needed, until they can be replaced with more reliable "meteor burst" or satellite communications. The Alaskan Region has a funded FY-81 program to purchase additional HF transceivers for use as needed for weather collection purposes. We believe this action satisfies the intent of Safety Recommendation A-80-101 and, accordingly, we consider action on this recommendation completed.

A-80-102. Locate and maintain permanently a Principal Operations Inspector and a Principal Maintenance Inspector at Nome, Bethel, Ketchikan, and at as many other regional aviation hubs as possible.

FAA Comment. It is not apparent to us why the Board has asked that we reconsider our response to this recommendation. Perhaps the actions we have in progress were not fully understood. In our letter of December 15, 1980, we informed the Board that the FAA is presently reexamining future inspector staffing requirements in Alaska. This review includes potential location assignment of domiciled inspectors. This study is continuing on schedule, and we anticipate completion in the immediate future. We will then finalize our findings and update the Board on the status of this recommendation.

A-80-103. Continue to develop, in cooperation with the National Weather Service, the concept of "meteor burst" technology for transmission of weather observations from rural villages to regional aviation hubs in Alaska.

FAA Comment. We are continuing our testing of "meteor burst" technology, and a third collection site has now been installed at Togiak, Alaska. We will inform the Board of significant progress as our efforts continue in this area.

A-80-104. Continue to develop and improve, in cooperation with the National Weather Service, the technology of the television weather observation system in Alaska.

FAA Comment. In our letter of December 15, 1980, we informed the Board that "slow scan" and "live scan" television observations were being tested at two Alaskan locations. The closed circuit television test at Unalakleet, Alaska, was not successful due to lack of contrast in the terrain. We plan to expand the test to include programmed stops in the equipment for better orientation. The test at Valdez, Alaska, was highly successful because of excellent terrain contrast, and three additional sites are now funded for further testing.

The FAA will continue to keep the Board informed of significant progress relative to Safety Recommendation A-80-104.

Sincerely,

J. Lynn Helms
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

March 26, 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Thank you for the Federal Aviation Administration's (FAA) letter of December 15, 1980, responding to National Transportation Safety Board Safety Recommendations A-80-101 through A-80-104 issued September 25, 1980. These recommendations stemmed from our "Special Study--Air Taxi Safety In Alaska" (NTSB-AAS-80-3). The study revealed that the nonfatal air taxi accident rate in Alaska is almost five times higher than the nonfatal air taxi accident rate in the rest of the United States, and the fatal air taxi accident rate is more than double the fatal air taxi accident rate of the rest of the United States. Our recommendations called for better weather reporting and for improvements in the FAA's organization for inspection.

The Safety Board is pleased with the FAA's position on the weather related recommendations A-80-101, -103, and -104. We look forward to receiving progress reports on these recommendations which we are maintaining in an "Open--Acceptable Action" status. In Safety Recommendation A-80-102 we asked the FAA to locate and maintain permanently a Principal Operations Inspector and a Principal Maintenance Inspector at Nome, Bethel, Ketchikan, and at as many other regional hubs as possible. We believe safety improvements can better be achieved by having inspectors permanently located at regional hubs rather than by temporary assignments from the Anchorage General Aviation District Office (GADO), no matter how frequently they occur. This is a view shared by many air taxi operators in Alaska.

The intent of this recommendation was not for the establishment of a full GADO, but rather to have satellite operations of the Anchorage GADO located at existing facilities in regional hubs. The Board believes that the unique dependence of Alaska, especially "bush" Alaska, on aviation indicates that criteria for establishing a satellite office of

the Anchorage GADO (especially in Bethel) should be different from those used in the remainder of the United States. We, therefore, request the FAA to reconsider this recommendation which we are maintaining in an "Open--Unacceptable Action" status.

Sincerely yours,

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

December 15, 1980

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D. C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-101 through A-80-104 issued by the Board on September 25, 1980. These recommendations resulted from the Board's study of air taxi accidents which occurred in Alaska from 1974 through 1978.

The Federal Aviation Administration's (FAA) Alaskan Region, in cooperation with the State of Alaska and the National Weather Service, is currently involved in high frequency (HF) transmissions to collect weather and airport information. We are also involved in the evaluation of "meteor burst" technology and television weather observations.

A-80-101.

Evaluate, in cooperation with the State of Alaska and the National Weather Service, the feasibility of equipping its flight service stations and the NWS-certified weather observers in rural villages with high-frequency transceivers that have the appropriate frequencies to facilitate the ground-to-ground communication of weather and runway conditions.

FAA Comment.

The FAA concurs in the intent of this safety recommendation and such an effort is currently in progress. The FAA's Alaskan Region is presently using HF transceivers to collect weather and airport information from remote locations. Due to the unreliable nature of HF, (atmospheric influences, skip, etc.), we plan to provide HF transceivers as needed, until they can be replaced with more reliable "meteor burst" or satellite communications.

A-80-102.

Locate and maintain permanently a Principal Operations Inspector and a Principal Maintenance Inspector at Nome, Bethel, Ketchikan, and at as many other regional aviation hubs as possible.

FAA Comment.

The FAA appreciates the intent of this recommendation, but we do not concur in substance. The establishment of GADO's or satellite offices at any location, including those in Alaska, is based upon a number of factors including the need for full-time FAA services and consideration of the various alternatives available to provide these services.

The FAA has, in the past, considered establishing additional GADO's at the locations identified in Safety Recommendation A-80-102. However, the workload historically has been cyclic, and we have been unable to justify domiciled GADO personnel at these locations. FAA inspectors from the Alaskan Region GADO's and FSDO's have provided required services through expanded travel and extended duration of assignment at these locations when activity has warranted. This flexibility of assignment has permitted FAA managers to meet the changing demands of the work situation in Alaska while still controlling growth of the Federal work force. The FAA is presently reexamining future inspector staffing requirements in Alaska. This review includes potential location assignment of domiciled inspectors. We expect to complete our study in April of 1981, and we will inform the Board of our findings and long-term staffing plans at that time.

A-80-103.

Continue to develop, in cooperation with the National Weather Service, the concept of "meteor burst" technology for transmission of weather observations from rural villages to regional aviation hubs in Alaska.

FAA Comment.

The FAA concurs in this safety recommendation, and "meteor burst" technology is presently being tested at two locations in Alaska. So far, the results have been favorable. Future plans for this concept are pending, and the FAA will continue to monitor this effort.

A-80-104.

Continue to develop and improve, in cooperation with the National Weather Service, the technology of the television weather observation system in Alaska.

FAA Comment.

The FAA concurs in this safety recommendation. "Slow scan" and "live scan" television observations are being tested at two Alaskan locations. More locations are planned subject to the outcome of these tests, and the FAA will continue to monitor this effort.

Sincerely,

Langhorne Bond

Langhorne Bond
Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: September 25, 1980

Forwarded to:
Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)
A-80-101 through -104

The National Transportation Safety Board has studied the air taxi accidents which occurred in Alaska from 1974 through 1978. Accident data from the Safety Board's automated aviation accident data system for that period were analyzed by means of frequency distributions. Safety Board staff also visited Alaska to see the conditions under which the air taxi community operates, to discuss the community's attitudes and needs, and to examine the community's interaction with Federal and State agencies. While in Alaska, the Safety Board staff met with officials of the Federal Aviation Administration (FAA), the National Weather Service (NWS), the Alaska Department of Transportation and Public Facilities (DOT/PF), the Alaska Air Carriers Association, and 17 air taxi operators. 1/

The State of Alaska is heavily dependent on its air taxi industry to transport food, medicine, mail, and many other necessities of life to rural villages. Alaska, however, has an air taxi safety problem. During the 5-year period 1974-1978, there were 311 air taxi accidents in Alaska, of which 266 were nonfatal and 45 were fatal, compared with 753 air taxi accidents in the rest of the United States, of which 562 were nonfatal and 191 were fatal. More importantly, the nonfatal air taxi accident rate (per 100,000 flying hours) in Alaska is almost five times higher than the nonfatal air taxi accident rate in the rest of the United States, and the fatal air taxi accident rate in Alaska is more than double the fatal air taxi accident rate in the rest of the United States.

The Safety Board study concluded that there are three major factors responsible for the high air taxi accident rate in Alaska: (1) the "bush syndrome," (2) inadequate airfield facilities and inadequate communications of airfield conditions, and (3) inadequate weather observations, inadequate communications of the weather information, and insufficient navigation aids. The "bush syndrome" is an attitude on the part of air taxi operators, pilots, and passengers in Alaska that ranges from a casual acceptance of risks to a willingness to take unwarranted risks. Most of the active airports in Alaska are State owned and maintained, and many of their runways are inadequately maintained. Whiteouts, very rapid weather changes, and a scarcity of navigation aids cause pilots to make many off-airport takeoffs and landings in float-equipped and ski-equipped aircraft. The collection and dissemination of weather information and current runway condition information is hampered by a shortage of trained personnel and an inadequate communications system in rural Alaska.

1/ For more detailed information read "Special Study--Air Taxi Safety in Alaska" (NTSB-AAS-80-3).

The relationship between the State's air taxi operators and the FAA appears to be strained. Further, because of a lack of permanent FAA inspectors at the rural aviation transportation hubs, there is insufficient opportunity for the FAA to provide guidance to the air taxi operators.

The State of Alaska has recently appropriated, through Chapter 50, SLA 1980, substantial funds for the improvement of the State aviation system, including upgrading of runways and the installation of navigation aids, and weather reporting and communications equipment. A comprehensive State aviation system plan, adequate to implement the intent of Chapter 50, SLA 1980, does not appear to exist. Further, centralized control over, and authority for, developing such a plan does not appear to exist within the current State DOT/PF structure. Cooperation among the State, the FAA, the NWS, and the air taxi operators must be increased if the State is to develop and implement the plan.

Based on the results of this study, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Evaluate, in cooperation with the State of Alaska and the National Weather Service, the feasibility of equipping its flight service stations and the NWS-certified weather observers in rural villages with high-frequency transceivers that have the appropriate frequencies to facilitate the ground-to-ground communication of weather and runway conditions. (Class II, Priority Action) (A-80-101)
>
> Locate and maintain permanently a Principal Operations Inspector and a Principal Maintenance Inspector at Nome, Bethel, Ketchikan, and at as many other regional aviation hubs as possible. (Class II, Priority Action) (A-80-102)
>
> Continue to develop, in cooperation with the National Weather Service, the concept of "meteor burst" technology for transmission of weather observations from rural villages to regional aviation hubs in Alaska. (Class II, Priority Action) (A-80-103)
>
> Continue to develop and improve, in cooperation with the National Weather Service, the technology of the television weather observation system in Alaska. (Class II, Priority Action) (A-80-104)

KING, Chairman, GOLDMAN and BURSLEY, Members, concurred in these recommendations. DRIVER, Vice Chairman, and McADAMS, Member, did not participate.

James B. King

By: James B. King
Chairman

US Department
of Transportation

**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

May 26, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendations A-80-112 and A-80-114 issued November 14, 1980. The FAA's initial response dated February 11, 1981, was acknowledged by the Board's letter of March 30, 1981. In that letter, Safety Recommendation A-80-112 was classified in an "Open--Acceptable Action" status, and A-80-114 was classified in an "Open--Acceptable Alternate Action" status. Recommendation A-80-113, classified by the Board in an "Open--Acceptable Action" status will be addressed in separate correspondence at a later date when more information is developed.

These recommendations resulted from the Board's investigation of two separate crashes. The first involved an Allegheny Airlines Nord 262 at Clarksburg, West Virginia, on February 12, 1979, and the second, a Redcoat Air Cargo, Ltd., Bristol Brittania 253 at Billerica, Massachusetts, on February 18, 1980. In both cases the Board identified problems involving the use of ethylene glycol as an anti-icing agent.

A-80-112. Advise operators of the potential hazard of an accumulation of wet snow on airfoil surfaces after deicing with a diluted ethylene glycol solution.

FAA Comment. The Federal Aviation Administration (FAA) concurred in this safety recommendation and informed the Board of our intent to issue an operations bulletin requesting operators to review their deicing and anti-icing procedures. Enclosed is an advance copy of Air Carrier Operations Bulletin No. 7-81-1--Aircraft Deicing and Anti-icing Procedures. With the issuance of this Bulletin, the FAA considers action on Safety Recommendation A-80-112 completed.

A-80-114. Publish and distribute to operators detailed information regarding the characteristics of deicing/anti-icing fluids and guidelines regarding their use.

FAA Comment. The FAA did not concur in this recommendation based on our belief that the manufacturer, rather than the FAA, should be responsible for this action. We do, however, appreciate the intent of the recommendation and, as stated in our previous response, action was initiated to issue an operations bulletin which requests air carrier certificate holders to insure that deicing/anti-icing procedures are included in company manuals. The enclosed advance copy of Air Carrier Operations Bulletin No. 7-81-1—Aircraft Deicing and Anti-icing Procedures completes FAA's action regarding this matter. Accordingly, the FAA considers action on Safety Recommendation A-80-114, completed.

Sincerely,

J. Lynn Helms
Administrator

Enclosure

3

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

MAR 30 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Thank you for your letter of February 11, 1981, responding to National Transportation Safety Board Safety Recommendations A-80-112 through A-80-114 issued November 14, 1980. These recommendations were made as a result of the accidents involving an Allegheny Airlines Nord 262 at Clarksburg, West Virginia, on February 12, 1979, and a Redcoat Air Cargo, Ltd., Bristol Brittania 253 at Billerica, Massachusetts, on February 16, 1980. They pertain to problems with the use of ethylene glycol as an anti-icing agent.

In Safety Recommendation A-80-112 we asked the Federal Aviation Administration (FAA) to advise operators of the potential hazard of an accumulation of wet snow on airfoil surfaces after deicing with a diluted ethylene glycol solution. We are pleased to learn that the FAA is preparing an operations bulletin to emphasize the dangers of snow accumulation on aircraft following deicing. The status of this recommendation is classified as "Open--Acceptable Action."

In A-80-113 we recommended that the FAA initiate a study of the effectiveness of ethylene glycol-based deicing fluid concentrations as an anti-icing agent under differing icing and snow conditions. We note that the FAA intends to initiate a study and inform the Safety Board of its findings. This recommendation is also classified in an "Open--Acceptable Action" status.

In Safety Recommendation A-80-114 we proposed that the FAA publish and distribute to operators detailed information regarding the characteristics of deicing/anti-icing fluids and guidelines regarding their use. We note that the FAA plans to issue an operations bulletin requesting air carrier certificate holders to ensure that deicing/anti-icing procedures are included in their manuals. This alternate action will satisfy the intent of A-80-114 which is classified in an "Open--Acceptable Alternate Action" status.

We thank the FAA for actions taken and ongoing to satisfy these recommendations.

Sincerely yours,

James B. King

James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

February 11, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendations A-80-112 through A-80-114 issued by the Board on November 14, 1980. These recommendations resulted from the Board's investigation of the crash of an Allegheny Airlines Nord 262, at Clarksburg, West Virginia, on February 12, 1979. The Board also investigated the crash of a Redcoat Air Cargo, Ltd., Bristol Brittania 253, at Logan International Airport, Boston, Massachusetts, on February 18, 1980.

A-80-112.

Advise operators of the potential hazard of an accumulation of wet snow on airfoil surfaces after deicing with a diluted ethylene glycol solution.

FAA Comment.

The Federal Aviation Administration (FAA) concurs in this safety recommendation and we are preparing an operations bulletin to emphasize the dangers of snow accumulation on aircraft following deicing. Operators will be requested to review their deicing and anti-icing procedures in view of these accidents. A copy of the operations bulletin will be forwarded to the Board when it is issued.

A-80-113.

Initiate a study of the effectiveness of ethylene glycol-based deicing fluid concentrations as an anti-icing agent under differing icing and snow conditions.

FAA Comment.

During the April 1969 Federal Aviation Administration Aircraft Ice Protection Symposium, it was emphasized that prior to flight, the final inspection must assure a clean-surfaced wing. This requirement remains valid regardless of the effectiveness of either fluid used; deicing or anti-icing. The FAA believes these criteria are adequate for release to taxi.

We also believe, however, that a study on ethylene glycol-water deicing mix as anti-icing agent under differing icing and snow conditions will provide significant information on wing surface snow accumulation from taxi to takeoff. Accordingly, we intend to initiate a study through our R & D organization and the Board will be informed of the results of this study.

A-80-114.

Publish and distribute to operators detailed information regarding the characteristics of deicing/anti-icing fluids and guidelines regarding their use.

FAA Comment.

The FAA does not concur in this safety recommendation because we believe the manufacturer, rather than the FAA, should be charged with this action. Detailed information regarding the characteristics of deicing/anti-icing fluids and guidelines regarding their use should be obtained from the manufacturer of the product, since only this source has the test data to backup claims of the effectiveness of its product.

We do, however, appreciate the intent of the recommendation. Accordingly, we plan to issue an operations bulletin which will request air carrier certificate holders to ensure that deicing/anti-icing procedures are included in their manuals.

We believe these actions will fulfill the intent of Safety Recommendations A-80-112 through A-80-114.

Sincerely,

Charles E. Weithoner
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: November 14, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-112 through -114

On February 12, 1979, an Allegheny Airlines Nord 262 crashed on takeoff from Clarksburg, West Virginia. The accident resulted in two fatalities and seven serious injuries. At the time of takeoff, there were light snow showers at the airport with an estimated accumulation rate of approximately 1 inch per hour. Deicing of the aircraft, with a 78-percent solution of an ethylene glycol-based deicing fluid and water, was completed 25 to 40 minutes prior to takeoff. Witnesses reportedly saw snow on the exposed horizontal surfaces of the aircraft when it taxied out. The probable cause of the accident was determined to be, in part, the loss of lateral control and lift due to snow on the wings and empennage when the aircraft climbed out of ground effect. The presence of frozen snow on the upper horizontal airfoil surfaces was confirmed by photographs after the accident.

On February 18, 1980, a Redcoat Air Cargo, Ltd., Bristol Brittania 253, crashed shortly after takeoff from Logan International Airport, Boston. The accident resulted in seven deaths and one serious injury. Light snow had fallen throughout the period of flight preparation, taxi, and takeoff at a rate of between 0.5 and 0.8 inch per hour. The aircraft had been deiced with a 30-percent solution of an ethylene glycol-based deicing fluid 45 to 60 minutes prior to takeoff. Evidence indicates that wet snow, which accumulated on the wings and horizontal stabilizer prior to takeoff, was a major factor in this accident.

Although an ethylene glycol-water mix is useful as a deicing agent, only the undiluted fluid is recommended by the manufacturer as an anti-icing agent. In the above accidents, the very fact that the exposed airfoil surfaces were wetted may have actually enhanced the accumulation of wet snow and created a condition in which the wet snow was not blown off by air moving over the surfaces.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Advise operators of the potential hazard of an accumulation of wet snow on airfoil surfaces after deicing with a diluted ethylene glycol solution. (Class I, Urgent Action) (A-80-112)
>
> Initiate a study of the effectiveness of ethylene glycol-based deicing fluid concentrations as an anti-icing agent under differing icing and snow conditions. (Class II, Priority Action) (A-80-113)
>
> Publish and distribute to operators detailed information regarding the characteristics of deicing/anti-icing fluids and guidelines regarding their use. (Class II, Priority Action) (A-80-114)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.

By: James B. King
Chairman

7C

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF THE ADMINISTRATOR

May 26, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-80-141 issued December 31, 1980, and supplements our letter of February 11, 1981. This recommendation resulted from the Board's investigation of the crash of a Texas International Airlines DC-9-10 on March 17, 1980, at Ryan Airport, Baton Rouge, Louisiana. The aircraft ran off the side of the runway during landing rollout causing injuries to two crewmembers and considerable damage to the aircraft.

A-80-141. Install appropriate recording equipment and make a continuous recording of both wind direction to the nearest degree and speed to the nearest knot at those airports where hourly surface aviation weather observations are made.

FAA Comment. In the Board's recommendation letter, it was stated that investigators need more detailed wind direction information when determining the environmental conditions that existed in the immediate vicinity of an airport at the time of an accident. At airports having Federal Aviation Administration (FAA) towers, such as Ryan Airport, a record of voice transmissions of the local controller is available. These transmissions contain the current winds in the immediate vicinity of the airport.

The Board's letter also stated that more complete wind records at airports are required to accurately determine the cause of accidents involving winds.

In consideration of the fact that voice transmission recordings of airport operations referred to above are available, we question the cost/benefit aspects of a more complete recorded wind data system, solely for the purpose of augmenting data used in analyzing accident

causes. It seems that availability of current and accurate wind information should be viewed as a valuable tool for use in enhancing safety of flight, rather than as a data source for accident investigation purposes. In any event, it is important to note that any determination regarding the value of more complete airport wind data for improving wind forecasts falls within the purview of the National Weather Service (NWS).

Current accuracy parameters, as well as proposed future automated criteria, require plus or minus 10 degrees in direction, and speed to the nearest knot with a tolerance of plus or minus 10 percent. Under current planning, these future systems will record only hourly weather reports and special weather reports of all weather elements, including wind, sensed by the system. In order to satisfy the intent of Safety Recommendation A-80-141, there would be a need to develop independent wind measuring and recording equipment, separate from that used by the NWS or the FAA. Such newly developed equipment would then have to be installed at approximately 450 airports where hourly surface weather observations are currently made.

It appears that the desirability of having such equipment available on a national scale is predicated upon the desire of the Board for additional data for use in accident analysis. In the absence of an economic analysis, which probably would disclose a disproportionate cost to benefit relationship, and in recognition of the role of the NWS, FAA intends to take no further action on this recommendation.

Sincerely,

J. Lynn Helms
Administrator

National Transportation Safety Board

Washington, D.C. 20594

Office of the Chairman

MAR 20 1981

Mr. Charles E. Weithoner
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

Dear Mr. Weithoner:

Thank you for your letter of February 11, 1981, responding to the National Transportation Safety Board's Safety Recommendation A-80-141. This recommendation stemmed from the Safety Board's investigation of a Texas International Airlines DC-9-10 accident at Ryan Airport, Baton Rouge, Louisiana, on March 17, 1980. The recommendation was addressed jointly to the Federal Aviation Administration (FAA) and the National Oceanic and Atmospheric Administration. We asked the FAA to:

> "Install appropriate recording equipment and make a continuous recording of both wind direction to the nearest degree and speed to the nearest knot at those airports where hourly surface aviation weather observations are made."

The Safety Board is pleased to note that the FAA is exploring means to accurately record wind speed and direction, and we appreciate the FAA's offer to keep us advised of its research efforts. Safety Recommendation A-80-141 is classified in an "Open - Acceptable Action" status.

Sincerely yours,

James B. King

James B. King
Chairman

cc: Mr. T. B. Owen
Assistant Administrator
National Oceanic and Atmospheric Administration
Rockville, Maryland 20852

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

February 11, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in response to NTSB Safety Recommendation A-80-141, issued by the Board on December 31, 1980. This recommendation resulted from the Board's investigation of the crash of a Texas International Airlines DC-9-10 on March 17, 1980, at Ryan Airport, Baton Rouge, Louisiana. The aircraft ran off the side of the runway during landing rollout causing injuries to two crewmembers and considerable damage to the aircraft.

A-80-141.

Install appropriate recording equipment and make a continuous recording of both wind direction to the nearest degree and speed to the nearest knot at those airports where hourly surface aviation weather observations are made.

FAA Comment.

This recommendation is directed jointly to the Federal Aviation Administration (FAA) and the National Oceanic and Atmospheric Administration (NOAA).

The FAA has, for some time, been exploring this area of accurate recording of wind information. Since this is already an ongoing effort, we believe it would be prudent to continue our research for the next 60 to 90 days in order to retain continuity and momentum in this program area. During this period we plan to examine current accuracy requirements for providing wind information to the pilot, current wind recording procedures, recording capability planned for future terminal systems, and coordinating procedures and capabilities with the National Weather Service. Accordingly, we intend to pursue these efforts and provide further response to the Board on or about April 30, 1981.

Sincerely,

Charles E. Weithoner
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: December 31, 1980

Forwarded to:

Honorable Richard A. Frank
Administrator
National Oceanic and Atmospheric
Administration
Rockville, Maryland 20852

SAFETY RECOMMENDATION(S

A-80-141

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On March 17, 1980, a Texas International Airlines DC-9-10 ran off the side of the runway during landing rollout at Ryan Airport, Baton Rouge, Louisiana, causing injuries to two crewmembers and considerable damage to the aircraft. Weather conditions at the time included light rain and winds which were veering from southerly to northwesterly and increasing from light to moderate, giving the aircraft an apparent tailwind on a runway that the Jeppesen Approach Chart indicated was restricted when wet to aircraft below 25,000 lbs with a zero tailwind or 10-knot crosswind. In determining the circumstances of this accident, the Safety Board investigators needed detailed information regarding the direction and speed of the surface wind prior to and at the time of the accident. However, the only detailed wind data available was wind speed as recorded by the gust recorder. Wind direction information was recorded on the operations recorder, but only once per minute and then only to the nearest 45 degrees of the 360-degree compass rose. Investigators need more detailed wind direction information when determining the environmental conditions that existed in the immediate vicinity of an airport at the time of an accident. There have been other major accidents in which the lack of surface wind direction information hindered the investigation; these include the Allegheny Airlines DC-9 accident at Philadelphia International Airport on June 23, 1976, and the Continental Airlines Boeing 727 accident at Tucson International Airport on June 3, 1977.

Adverse surface winds have been and continue to be a major problem in terminal operations. To determine accurately the cause of accidents involving such winds and to obtain data for the research necessary to improve wind forecasts and warnings, more complete wind records at airports are required. These should be continuous graphical records which provide values for both wind direction to the nearest degree and speed to the nearest knot on a common time ordinate.

3122

Therefore, the National Transportation Safety Board recommends that the National Oceanic and Atmospheric Administration and the Federal Aviation Administration:

> Install appropriate recording equipment and make a continuous recording of both wind direction to the nearest degree and speed to the nearest knot at those airports where hourly surface aviation weather observations are made. (Class III, Longer-Term Action) (A-80-141)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in this recommendation.

Francis H. McAdams

For By: James B. King
Chairman

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

May 26, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, D.C. 20594

Dear Mr. Chairman:

This is in further response to NTSB Safety Recommendation A-81-1 issued by the Board on January 6, 1981, and serves as a followup to the Federal Aviation Administration's (FAA) letter dated February 11, 1981. This recommendation was one of five recommendations issued as a result of the Board's investigation of a Lockheed L-1011-200 airplane operated by a foreign carrier which experienced an in-flight failure of a main landing gear outboard wheel flange on December 22, 1980.

A-81-1. Issue an immediate Airworthiness Directive to require that operators of L-1011 aircraft at the next tire change or within 20 cycles, whichever is sooner, measure the flange thickness on all P/N 3-1365 wheels with serial number up to 1404 which have been used on aircraft with a gross takeoff weight of 430,000 pounds or more, and include in the Airworthiness Directive a requirement to remove all wheels with outer flange thicknesses of less than 0.490 inch and installed on aircraft operating at gross takeoff weights of 30,000 pounds or more. Further requirements should include at each wheel disassembly of all P/N 3-1365 and P/N 3-1311 wheels, an inspection in accordance with procedures which have been evaluated by the FAA and demonstrated by industry experience to be effective in detecting in-service cracking prior to failure.

FAA Comment. Enclosed is a copy of the airworthiness directive (AD) which was issued as a final rule on March 13, 1981. The AD requires inspection of Lockheed Model L-1011 series aircraft main landing gear wheels and the removal from service of all wheels found to have cracks.

We consider action completed on Safety Recommendation A-81-1.

Sincerely,

J. Lynn Helms
Administrator

Enclosure

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

February 11, 1981

The Honorable James B. King
Chairman, National Transportation
Safety Board
800 Independence Avenue, SW.
Washington, DC 20594

Dear Mr. Chairman:

This is in response to National Transportation Safety Board (NTSB) Safety Recommendations A-81-1 through A-81-5 issued by the Board on January 6, 1981. These recommendations resulted from the Board's investigation of a Lockheed L-1011-200 airplane operated by a foreign carrier which experienced an inflight failure of a main landing gear outboard wheel flange on December 22, 1980. The following comments are provided in response to these recommendations.

A-81-1

> Issue an immediate Airworthiness Directive to require that operators of L-1011 aircraft at the next tire change or within 20 cycles, whichever is sooner, measure the flange thickness on all P/N 3-1365 wheels with serial number up to 1404 which have been used on aircraft with a gross takeoff weight of 430,000 pounds or more, and include in the Airworthiness Directive a requirement to remove all wheels with outer flange thicknesses of less than 0.490 inch and installed on aircraft operating at gross takeoff weights of 430,000 pounds or more. Further requirements should include at each wheel disassembly of all P/N 3-1365 and P/N 3-1311 wheels, an inspection in accordance with procedures which have been evaluated by the FAA and demonstrated by industry experience to be effective in detecting in-service cracking prior to failure.

FAA Comment:

For the purpose of comment, we have separated this recommendation into two parts: First, to require early identification and removal of wheels with outer flange thicknesses of less than 0.490 inch, i.e., "thinner flange wheels," from airplanes having a takeoff gross weight of more than 430,000 pounds, but not greater than 466,000 pounds, i.e., "heavier airplanes;" and, secondly, to require appropriate inspections of wheels at each wheel disassembly, i.e., at each tire change. Each of these parts is addressed separately.

The B. F. Goodrich P/N 3-1311-3 and P/N 3-1365 wheels, including the thinner flange P/N 3-1365 wheels, are approved for installation on the heavier airplanes. We have reevaluated this approval and have found no significant difference in safety between these parts. The dimensional

differences are slight, and, considering the typical fatigue failure mode, the increased thickness is not, of itself, significant enough to contribute to the safety of the wheel.

As you know, there are strong indications that corrosion pits initiated the crack that caused the subject wheel failure. Corrosion has been present in many of the cracked or failed wheels from L-1011 airplanes that have been returned to B. F. Goodrich or Lockheed for analysis. Once a surface anomaly such as a corrosion pit develops, and these can develop at any time during the wheel service life, a fatigue crack can be expected to initiate and grow from that anomaly. The minor difference in flange thickness is an insignificant factor when this phenomenon occurs.

Federal Aviation Administration (FAA) specialists have been working with specialists from Lockheed and B. F. Goodrich in an effort to investigate the crack propagation characteristics of a thinner flange wheel on a heavier airplane once a detectable fatigue crack is present. The purpose of the investigation is to determine the appropriateness of present inservice inspection intervals. Enlarged photographs of the fracture surface of the subject failed wheel have been compared with the fracture surfaces of four other wheels that had been returned to Lockheed for analysis prior to the subject failure. In all cases, "marker bands" are apparent that can be correlated with the number of landings. Fractographic analysis shows that, for typical wheel failures originating from a surface anomaly such as a corrosion pit, which would be the most severe case of stress concentration, inspection using appropriate procedures at every tire change will allow several inspection opportunities to detect a crack prior to wheel flange failure on the thinner flange wheels, even on the heavier airplanes.

Therefore, we have concluded that appropriate flange inspection procedures, including method and period, are the key factors in preventing future wheel flange fatigue failures on L-1011 airplanes. Given the proper inspection, the differences in flange thickness are insignificant to safety. Moreover, if a proper inspection program is not implemented, the differences in flange thickness would not significantly forestall failure. Since we do not find the differences in flange thickness significant to safety, we are unable to justify the initiation of the action recommended, i.e., flange wheels measurement or removal of wheels with thinner flanges.

The last sentence of the recommendation seems to infer that presently there is no effective inspection procedure in use by the operators to detect inservice wheel cracking prior to failure. At the joint FAA/NTSB meeting with the Air Transport Association (ATA) member operators of L-1011 airplanes at Atlanta, GA, on December 31, 1980, several eddy current inspection techniques were described that are presently being used by L-1011 operators. Data was presented which shows that L-1011 wheel cracks are being detected on a regular basis prior to inservice failure. One of the operators rejected 73 wheels in a 29 month period using these eddy current inspections. All of the inspection procedures used by the operators are reviewed by the FAA and approved as part of the operator's maintenance procedures. Thus, the basic intent of the last sentence of the recommendation is presently being accomplished.

Since the joint FAA/NTSB/ATA meeting, the FAA has been following an analysis by Lockheed and B. F. Goodrich to improve even further the safety record of L-1011 wheels by defining an optimum inspection procedure for all wheels used on all L-1011 series airplanes. Many L-1011 operators have been involved in this intense effort at Lockheed. We are now confident that an optimum eddy current wheel flange radius inspection procedure for these B. F. Goodrich wheels has been developed. Consistent with our determination and in concurrence with the second part of your recommendation, we will issue an Airworthiness Directive (AD) to require application of these procedures at an appropriate inspection interval.

After the issuance of this AD, we consider FAA action completed on Recommendation A-81-1. Upon publication, we will furnish a copy of the AD to the Board.

A-81-2

> Initiate an immediate survey of B. F. Goodrich manufacturing facilities by a Quality Assurance Systems Analysis Review Team or equivalent to assure the manufacturer's compliance with current regulatory requirements governing production certification and specifically the issuance and approval of service bulletins, investigation and reporting of service difficulties, maintenance of appropriate production and inspection records, and coordination of service difficulties with primary airframe manufacturers.

FAA Comment:

Upon return of the failed wheel to your metallurgical laboratory in Washington, DC, we observed that the outboard wheel half P/N 10-1323 had been stamped over a previously stamped P/N 10-1213.

As soon as we saw the part number overstamping, i.e., part renumbering on the subject wheel, we requested our Great Lakes Region manufacturing specialist to initiate an investigation at B. F. Goodrich. Our manufacturing specialist visited the B. F. Goodrich plant on December 30, 1980, and, as reported at the joint FAA/NTSB/ATA meeting in Atlanta, GA, on December 31, 1980, he found that the part renumbering was covered by appropriate engineering orders which our review has shown to be appropriate. The error with respect to identification of the P/N 3-1311-3 cross-section shown on B. F. Goodrich Service Bulletin No. 369, which confused both the FAA and NTSB investigators at the outset, has no relationship to the B. F. Goodrich quality control system. In the service bulletin figure, B. F. Goodrich erroneously labeled the outboard flange of the P/N 3-1311-3 wheel with the inboard flange dimensions. We do not find that the errors in the service bulletin are indicative of lax quality control procedures at B. F. Goodrich. Also, since we have concluded that there is no safety significance to the small differences in flange thickness through the change in P/N's 3-1311-3 to 3-1365, we do not find that the confusion in part numbers could have contributed to the subject wheel failure.

Notwithstanding the above, consistent with your recommendation, we completed a special Quality Assurance System Analysis Review (QASAR) audit of the B. F. Goodrich wheel manufacturing facility at Troy, Ohio, on January 12 through 14. Emphasis was placed on reviewing the production and quality control procedures applied to the manufacture of wheels for L-1011 airplanes. The QASAR team leader has advised that there were no safety significant deficiencies found that could have contributed to the subject wheel failure, or that would affect the safety of wheels being manufactured at the facility.

We consider FAA action completed on recommendation A-81-2.

A-81-3

> Require tire, wheel, and airframe manufacturers to publish and disseminate to all operators all engineering data necessary to determine the effect on fatigue life of aircraft wheels by increasing or decreasing tire inflation pressures.

FAA Comment:

The predicate of this recommendation appears to be that a discrete fatigue life can be placed on an aircraft wheel and used to prevent wheel failures. Since our experience with prior cracks in L-1011 wheels indicates that surface anomalies (corrosion pits, etc.), are the principal initiators of wheel flange fatigue cracks, which may occur at any wheel service life and are independent of variations in operational stress level due to differences in tire pressure, we do not find this predicate valid. Therefore, we do not plan to implement Recommendation A-81-3.

As you know, the FAA has recently hired an internationally respected specialist in fracture mechanics and metallurgy. This specialist has been working with Lockheed and B. F. Goodrich in their analyses of the subject wheel failure and their review of earlier, less catastrophic failures. He will continue in his study of the wheel fatigue phenomenon on all U.S.-manufactured transport category airplane types in service so that we might better understand and thus miminize future wheel failures from whatever cause. As stated in response to Recommendation A-81-1, we believe the key to precluding "on-airplane" wheel flange failures lies in the integrity of the operators' wheel inspection program. As more is learned about the wheel flange fatigue phenomenon, improved wheel inspection procedures and periods will be defined for each wheel model.

We are concerned that the premature dissemination of the tire pressure effects information per your recommendation could cause operators to

reduce tire pressure to reduce wheel fatigue. We are concerned that since corrosion pits or other surface anomalies appear to be the predominant fatigue initiators, this action could lead to a false sense of security without improving wheel safety.

A-81-4

> Establish a program with air carriers, wheel, and airframe manufacturers to determine effective nondestructive inspection techniques for the variety of aircraft and wheel combinations in air carrier service and require operators to implement effective inspection programs.

FAA Comment:

This recommendation will be implemented as an integral part of the study mentioned in our response to Recommendation A-81-3. The details of the inspection procedure must be tailored to the principal failure causes and modes of each wheel type. Interim maintenance bulletins will be published and the final results of our study will be published in an Advisory Circular, both of which will be made available to the Board.

A-81-5

> Expeditiously disseminate any required wheel inspection and service programs to all foreign civil aviation authorities with regulatory responsibilities over operators of U.S.-manufactured aircraft and equipment.

FAA Comment:

As you know, on January 9 the Director of Airworthiness sent an "Urgent Maintenance Alert" telegraphically to the airworthiness authorities of all countries having L-1011 airplanes on their registry. The alert was also copied to the ATA and International Air Transport Association for dissemination to their member carriers. The alert emphasized the importance of an eddy current inspection of the critical wheel flange area at each tire change. The information in that alert will be upgraded by the forthcoming AD mentioned in our response to Recommendation A-81-1.

Any new information gained as a result of our wheel study mentioned in response to Recommendation A-81-3 will be made available to foreign authorities and all operators on a priority basis.

Technical Corrections and Clarification:

The preamble to your Recommendations A-81-1 through A-81-5 contained a number of factual errors that need to be corrected for the record.

In paragraph two, the B. F. Goodrich P/N 3-1311-3 and 3-1365 wheels are approved for use on L-1011 airplanes having a maximum certificated gross takeoff weight of up to 466,000 pounds, not 460,000 as stated. In paragraph three, the recommendation states "Subsequent engineering drawing changes strengthened the P/N 3-1365 wheel by including thicker outer flanges, anodizing, and shot peening." Anodizing does not strengthen the wheel, but is used to improve the corrosion resistance of the wheel. A review of drawing 10-1323, which makes up the outer half of wheel assembly P/N 3-1365, shows that the inside radius of the wheel bead, where the crack occurred, is not shot peened but is stress rolled. Other portions of the wheel are shot peened. The stress rolling of the wheel bead was not added as a revision to the drawing but was on the initial issue of the drawing.

Also, we would like to clarify some issues. The Board states in its letter that domestic air carriers have reported a significant number of fatigue-related failures of B. F. Goodrich P/N 3-1311-3 wheels, while P/N 3-1365 wheels have a satisfactory service record. It should be pointed out that both of these wheels were certificated to the same load rating for use on L-1011 airplanes up to a gross weight of 466,000 pounds, and both part number wheels have a satisfactory safety-related service record. The service record does not show a significantly higher failure rate of P/N 3-1311-3 or thin-flanged P/N 3-1365 wheels operated on airplanes with gross weights of 466,000 pounds. The FAA has not found that the P/N 3-1311-3 or P/N 3-1365 wheels with the thinner flanges have a more significant number of fatigue-related failures, and, in absence of engineering data to the contrary, finds that the P/N 3-1311-3 and P/N 3-1365 wheels are safe on all gross weight airplanes up to 466,000 pounds. The changes in P/N 3-1365 wheel flange thickness were instituted to increase service life and are not related to safety deficiencies. Some operators may elect to use only the P/N 3-1365 thicker flange wheels on high gross weight L-1011 airplanes to increase the service life of the wheels.

There appears to be an inference in the text of your discussion concerning these recommendations that inservice wheel rejections as a result of cracks are indicative of poor wheel design. These wheels were designed to meet the requirements of TSO-C26b, and the warranty service life desired by operators. The desired wheel life strongly dictates the design of the wheel. Wheels are not life limited but are used in service until cracks are detected, and the wheel is then scrapped. Airline maintenance procedures and inspection intervals are designed and FAA

approved to detect cracks prior to catastrophic failure of the wheel. The criterion of concern with respect to wheels is not the total number of wheel rejections, but whether the occurrence of a catastrophic crack between inspection intervals can be prevented.

Sincerely,

Charles E. Weithoner
Acting Administrator

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: January 6, 1981

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-81-1 through -5

A Lockheed L-1011-200 aircraft operated by a foreign carrier recently experienced an in-flight failure of a main landing gear inboard wheel flange. The failure caused major damage to flight control, electrical, and hydraulic systems, caused major damage to the aircraft structure, and resulted in explosive decompression of the cabin. There were two fatalities. Members of the FAA technical staff have been working closely with the National Transportation Safety Board's staff to determine the nature of the problem and the corrective actions required to prevent similar occurrences.

The continuing investigation has determined that the failed wheel was a B.F. Goodrich part No. (P/N) 3-1365, serial No. (S/N) 185. Information from Goodrich and Lockheed disclosed that Goodrich wheels P/N 3-1311-3 and P/N 3-1365 were both qualified to technical standard order (TSO) requirements for use on L-1011 aircraft having a maximum gross takeoff weight of up to 460,000 pounds. Domestic air carrier users of the L-1011 have reported a significant number of fatigue-related failures of the P/N 3-1311 wheels, but the P/N 3-1365 wheels have had a satisfactory service history. Goodrich warranty provisions, the relative service histories, and Goodrich Service Bulletin No. 369 all fostered the belief that the P/N 3-1365 wheels were stronger than the P/N 3-1311 wheels. Consequently, most operators use only the P/N 3-1365 wheels on those L-1011 aircraft operating at high gross weights.

Goodrich Service Bulletin No. 369 states that the thicknesses of P/N 3-1365 wheel outer flanges up to S/N 1404 are 0.490 to 0.550 inch. However, the Safety Board has learned from Goodrich that it manufactured an early quantity of wheels given P/N 3-1365 which were dimensionally and materially identical to the P/N 3-1311 wheels. Subsequent engineering drawing changes strengthened the P/N 3-1365 wheel by including thicker outer flanges, anodizing, and shot peening. Goodrich initially stated that the first flange dimensional change to the P/N 3-1365 wheel was effective on S/N 165. However, a postaccident laboratory examination disclosed that the outer flange of the failed wheel, S/N 185, measured less than 0.470 inch, which is below the minimum tolerance of 0.490 for the strengthened P/N 3-1365 wheel. The Service Bulletin does not mention that an early quantity of P/N 3-1365 wheels were manufactured before the engineering changes were incorporated.

Goodrich Service Bulletin No. 369 also states that the thicknesses of the P/N 3-1311 wheel outer flanges are 0.450 to 0.510 inch. According to engineering drawings submitted to the Safety Board by Goodrich, the specified dimensions for the P/N 3-1311 outer flanges are 0.410 to 0.470 inch. We believe that these errors are indicative of lax quality control procedures. The erroneous Service Bulletin information is misleading to the user and could contribute to confusion regarding the strength and durability of those wheels which are selected for use on L-1011 aircraft having higher gross weight configurations. Additional uncertainty as to the actual dimensional characteristics of the P/N 3-1365 wheels is created by the fact that Goodrich has previously indicated that P/N 3-1365 wheel assemblies up to about S/N 165 are the "same" as P/N 3-1311 assemblies. Disclosure of the less than 0.470 inch flange thickness on the failed S/N 185 wheel assembly thus creates a question as to exactly how many wheels with these dimensions are identified as P/N 3-1365 assemblies.

Discussions among the Safety Board staff, FAA staff, and the domestic air carriers have disclosed that all of the operators employ some inspection programs involving periodic eddy current or dye penetrant techniques. Before the accident it was generally believed that these programs were effective in detecting fatigue damage before catastrophic failure. However, the Safety Board remains concerned that the inspection requirements are not standardized and have not been uniformly effective in reliably detecting cracks prior to in-service failures. In fact, the foreign operator involved in this accident also used an eddy current inspection program and the failed wheel was inspected only 28 cycles before the accident. The Safety Board strongly believes that an effective inspection program is a vital element in the prevention of wheel failures and that the procedures proven by industry experience to be effective should be identified and required to be implemented by all carriers.

Furthermore, the Safety Board notes from Service Difficulty Reports that wheel failures are occurring with nearly all types of commercial aircraft. Therefore, the Safety Board believes that action to establish more reliable wheel inspection procedures should not be limited to the L-1011 wheels.

Accordingly, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an immediate Airworthiness Directive to require that operators of L-1011 aircraft at the next tire change or within 20 cycles, whichever is sooner, measure the flange thickness on all P/N 3-1365 wheels with serial number up to 1404 which have been used on aircraft with a gross takeoff weight of 430,000 pounds or more, and include in the Airworthiness Directive a requirement to remove all wheels with outer flange thicknesses of less than 0.490 inch and installed on aircraft operating at gross takeoff weights of 430,000 pounds or more. Further requirements should include at each wheel disassembly of all P/N 3-1365 and P/N 3-1311 wheels, an inspection in accordance with procedures which have been evaluated by the FAA and demonstrated by industry experience to be effective in detecting in-service cracking prior to failure. (Class I, Urgent Action) (A-81-1)

Initiate an immediate survey of B.F. Goodrich manufacturing facilities by a Quality Assurance Systems Analysis Review Team or equivalent to assure the manufacturer's compliance with current regulatory requirements governing production certification and specifically the issuance and approval of service bulletins, investigation and reporting of service difficulties, maintenance of appropriate production and inspection records, and coordination of service difficulties with primary airframe manufacturers. (Class I, Urgent Action) (A-81-2)

Require tire, wheel, and airframe manufacturers to publish and disseminate to all operators all engineering data necessary to determine the effect on fatigue life of aircraft wheels by increasing or decreasing tire inflation pressures. (Class I, Urgent Action) (A-81-3)

Establish a program with air carriers, wheel, and airframe manufacturers to determine effective nondestructive inspection techniques for the variety of aircraft and wheel combinations in air carrier service and require operators to implement effective inspection programs. (Class II, Priority Action) (A-81-4)

Expeditiously disseminate any required wheel inspection and service programs to all foreign civil aviation authorities with regulatory responsibilities over operators of U.S.-manufactured aircraft and equipment. (Class I, Urgent Action) (A-81-5)

KING, Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations. DRIVER, Vice Chairman, did not participate.

James B. King

By: James B. King
Chairman